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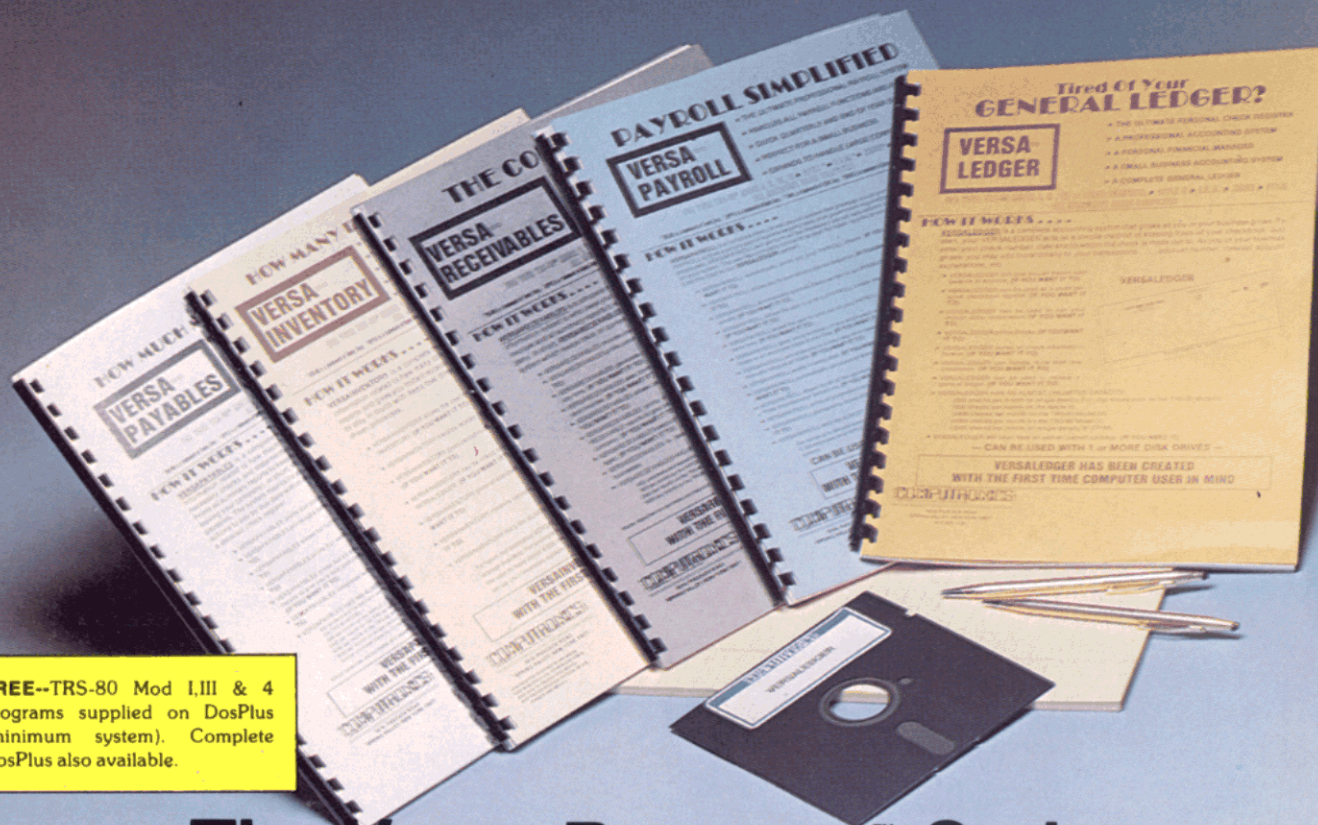
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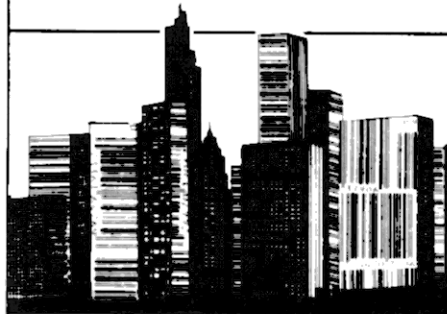
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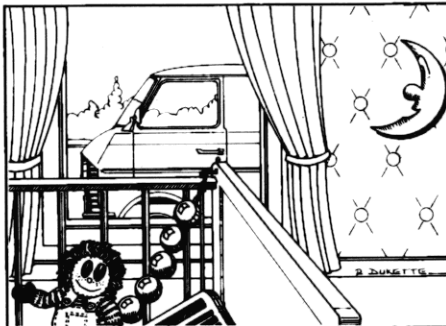
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The microcomputer market has developed a reputation for shifting like a sand dune. Certainly, the summer's shake-up in the low-end market and accompanying dip in high-tech stocks reinforces that impression.

But you get another perspective if you step back and view the situation in a historical context (however short that history may be). The fact is that the companies who were on top three years ago are still there. And everyone else is still scrambling to get a decent share of the market.

In 1980, the leaders were Tandy, Apple, and Commodore. The only company since then to take a significant portion of the market is, of course, IBM. Others—Sinclair, Atari, Texas Instruments, and Osborne, to name a few—have had their chance. None has done too well.

What's the secret? Why do the Big Four enjoy continued success while the rest flail around in apparent helplessness?

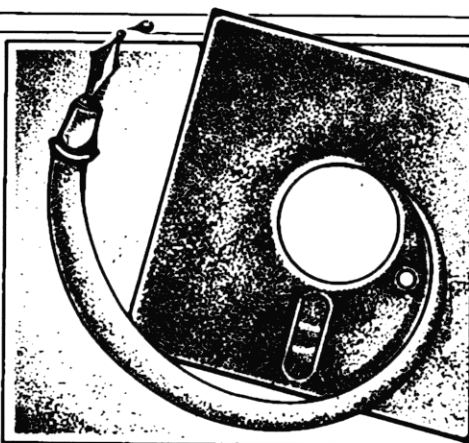
To begin with, the leaders offer fundamentally sound machines that promise a certain amount of longevity. Note, for instance, the number of TRS-80 Model I's still in use. Nearly half of 80 *Micro*'s subscribers still own Tandy's original micro, which hasn't been made since 1981. Some of these machines are six years old.

Contrast this with the fate of the Timex-Sinclair 1000, one of the hottest consumer products of any kind in 1982-83. The odds are that most will be junked or lost in a closet within a couple of years.

Second, the successful companies anticipated and addressed future markets. Tandy's Model 100 is an example; Tandy saw the need for a truly portable micro and filled the void. The 100 was an instant success, both critically and commercially.

Osborne, on the other hand, failed to follow up quickly enough on their initial success. They put out a transportable that begged to be made obsolete, and didn't have anything to take its place when interest sagged and sales dropped.

Third, Tandy et al know how to market their products. Say what you want about Tandy's chintzy newspaper inserts—the bottom line is that the company has sold a lot of computers. One



Shifting silicon sands

wonders how effective TI's ads—with Bill Cosby mugging for the Jell-O and Coke crowds—can be, or whether Atari has taken the proper steps to unburden itself of its image as a game maker.

Finally, the major computer manufacturers have managed to avoid some of the effects of the faddism that has struck the industry. The average Tandy customer puts thought into his purchase, and knows what he wants to do with his system. And he never has any problems finding new uses for it.

The average Sinclair customer, on the other hand, buys a T-S 1000 because he has vague thoughts of becoming computer literate (whatever that means), or because his kids want a microcomputer. Eventually, the computer falls into disuse because no one knows what to do with it. The Sinclair is not a machine that will engender a great deal of respect among the buying public, any more than the Chevy Vega will ever be considered a real car.

The moral of this story is that while we can expect to see a general slowdown in the entire micro market, we can also expect that Tandy will continue to be one of the more stable manufacturers, and that the TRS-80 line will hold onto a goodly portion of the market. They, along with Apple, Commodore, and IBM, stand head and shoulders above the pack, and it will require a ma-

jor effort on Tandy's part to bungle their share of the lead.

A Blizzard of Paper

A recent report from International Resource Development of Norwalk, CT, confirms what we here have suspected for some time—that while electronic mail may be faster and more efficient, it may not necessarily be more effective. The reason, says the report, is that e-mail is impersonal, and takes "the humanity out of a communication." The result, it concludes, is that people will turn to stationery and other forms of more personal correspondence.

"[Paper] is a symbol of authority, it dispels doubt as to the existence of a transaction, it represents an extension of the individual that necessarily—by its very nature—is far more intimate than a piece of computer hardware," says IRD's press release on the report.

As members of CompuServe, we've been receiving an increasing number of query letters—letters in which authors ask us whether we're interested in articles they're working on—through e-mail. And we've noticed that our tendency is to pay less attention to these letters than to personal letters sent via the U.S. mail.

We don't do it on purpose. But all e-mail looks the same. Each letter pops up on the screen in the same fashion, and each is dumped to the same printer to be cranked out in the same dot-matrix style on the same perforated paper. A half-dozen such letters in a pile have little to distinguish themselves from one another.

A personal letter, on the other hand, says a great deal about the author. The envelope, the kind of stationery, the letterhead, the way in which the letter is formatted, the signature—together with the text, they sketch a portrait of the author. And each portrait is distinct from the next.

So the next time you're ready to send out a letter electronically, think about it first. Is the medium lessening the impact of the message? If so, perhaps you should forego the wonders of the electronic nation for the dependability of typewriter and paper. It's a means of communication that will never outlive its effectiveness. ■

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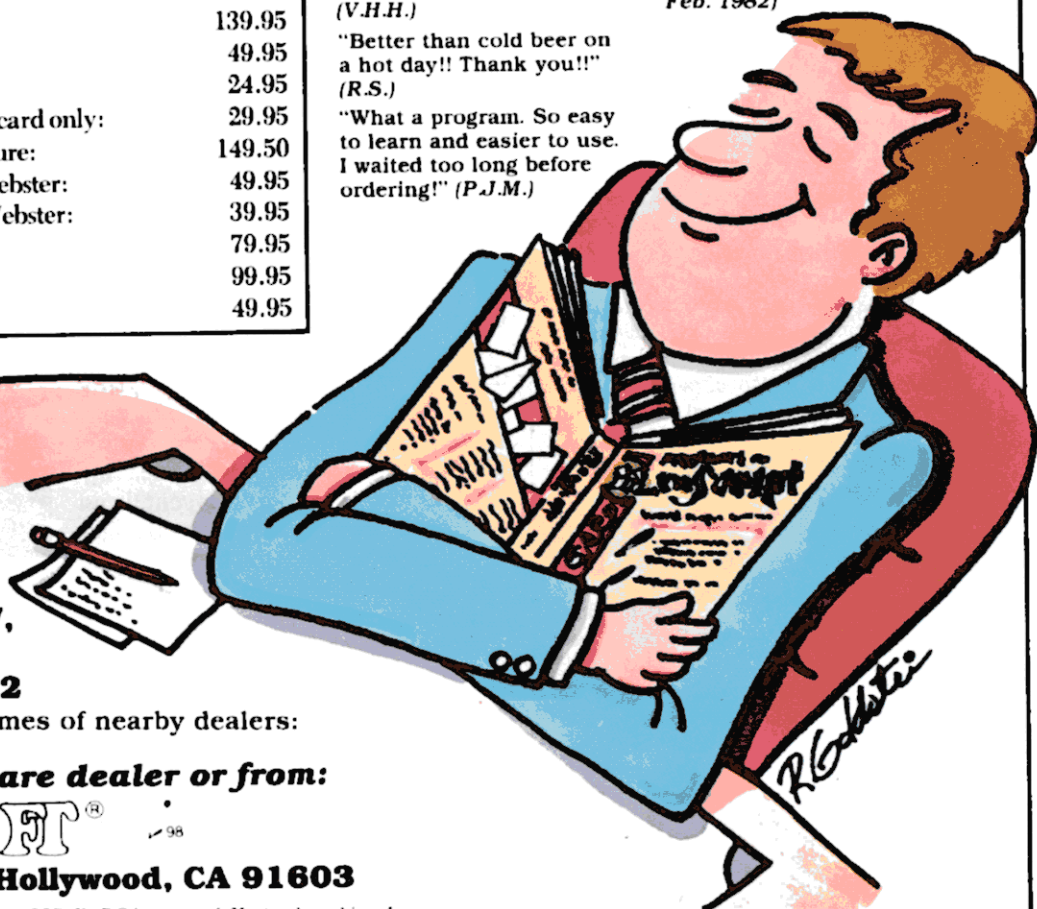
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80 formats its program listings to run 64-characters wide, the way they look on your video screen. This accounts for the occasional wrap-around you will notice in our program listings. Don't let it throw you, particularly when entering assembly listings.

Article submissions from our readers are welcomed and encouraged. Inquiries should be addressed to: Submissions Editor, 80 Pine Street, Peterborough, NH 03458. Include an SASE for a copy of our writers' guidelines. Payment for accepted articles is made at a rate of approximately \$50 per printed page; all rights are purchased. Authors of reviews should contact the Review Editor, 80 Pine Street, Peterborough, NH 03458.

PROOF NOTES

The editors look at the issues

What's black and white, read all over, and has a temperature of 103? Bar code fever! If you haven't got it yet, watch out—you can catch it from these pages. In this issue we'll introduce you to bar code technology, tell you how to print and read bar codes, and provide you with all the good stuff you buy *80 Micro* for: utilities, tutorials, techniques, games, news, reviews, and so on.

Bar codes provide an efficient and reliable means of data entry and transfer. Already a familiar sight at the supermarket in the form of the Universal Product Code (UPC), bar codes increase productivity, security, and data integrity in controlling inventory and maintaining records.

In addition to grocery and retail applications, bar codes are used increasingly in industry, government agencies, libraries, hospitals, and laboratories.

Computers read bar codes, a series of bars and spaces, by several means. All readers use a laser beam that scans the message in the bar code and transfers it to the computer. Sure to become most popular with micro users is the handheld wand that gives bar coding the portability and versatility to make it such an attractive means of data input.

Although not a replacement for the keyboard, bar code scanners are a significant and time-saving alternative to keyboard data entry. Best of all, reading bar codes doesn't require a skilled operator—it's so easy a monkey could do it.

Here at *80 Micro*, the fever has everyone thinking of how bar codes will someday improve our magazine. Imagine, if you will, opening your latest issue of *80 Micro*, picking up a pen-like device attached to your TRS-80, and, with a wave of your hand, transferring entire program listings into the computer quickly, accurately, and easily.

Imagine also using bar codes to enter the table of contents into a file to build a handy, complete index to *80 Micro* subjects and articles.

These are just two potential bar code applications to make *80 Micro* more accessible to you. We are so excited by it all that bar codes have become an ob-

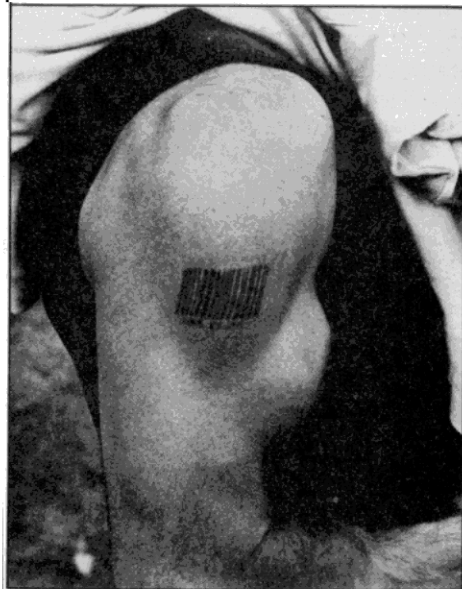
Bar code fever

session with many of us. Members of our softball team, the Generics, proudly wear a large bar code emblazoned on our uniforms. A few of us have even thought about bar code tattoos.

This issue supplies you with enough material to bring on the initial symptoms of bar code fever. With the bar code generators on pp. 104 and 114 you can use your Model III and a dot-matrix printer to print four of the most popular bar codes, including the Universal Product Code. And "Decoding Bar Codes" on p. 128 lets your Model III read bar codes.

Although you can adapt many bar code readers to TRS-80 computers, the virtual lack of interfacing software keeps many TRS-80 owners from jumping onto the bar code bandwagon. We'd like to hear from any of you who develop bar code reader interfacing software. ■

—A.C.



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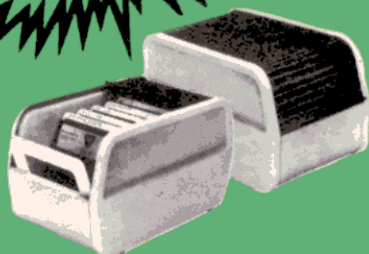
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Radio Shack Rebuttal

I would like to respond to Charles Austin's letter in Input (August 1983, p. 16). While it is true that we find it better to use sales tickets than to use a cash register (for a number of reasons), we certainly do use our own computers in-house.

Our company-owned stores each contain a Model III in what we call our store operating system. This system allows each store to do all of its daily sales receipts, payroll, and ordering via computer.

Once every day, all 4,500-plus computers communicate via a packet switching network to our main computer system in Fort Worth. We dispatch orders for quick-ship items within 24 hours of receiving the order.

In addition, we dispatch normal ship time orders more quickly than was possible when we did all of this work by mail.

This system is capable of providing us with day-to-day information on sales from various stores, even to the point of catalog numbers and sales by store salesperson.

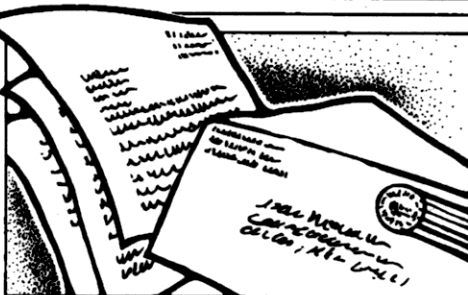
The Fort Worth computer can update each store's inventory records with price changes, availability, and other information. We can also automatically place into those records new products as they are available in our warehouses. To our knowledge, this is the largest such computerized system in existence.

Our warranties are good (on equipment purchased from a Radio Shack store or authorized dealer) anywhere in the United States, and no warranty cards are involved.

Your warranty is based solely upon that little old-fashioned sales ticket that our store personnel give you when you make your purchase.

Were it not for that ticket, you would probably have to return your product to the store from which you bought it, because only they would know when you purchased it, and that you were the original owner.

The ticket also keeps our mailing



list up to date so that we can send you flyers announcing new and exciting products to go with your existing Radio Shack equipment.

So you see, there is a method to our madness.

Ed Juge
Director, Computer Merchandising
Radio Shack
1500 One Tandy Center
Fort Worth, TX 76102

NEWDOS/80 User's Group

I'd like to initiate a user's group through which users of NEWDOS/80 can share and exchange ideas. Anyone interested is invited to write. I'd be pleased to hear any ideas on the best way to set up an exchange, or any other ideas, tips, or questions related to NEWDOS/80.

Please enclose a self-addressed, stamped envelope for replies.

Jack D. Feka
P.O. Box 1717
Victoria, B.C. V8W 2Y1
Canada

Fortran Addition

In "Fortran Breakout" (July 1983, p. 186), J.B. Harrell III wrote that "Fortran has 'record directed' input and output. This means each Read and Write statement produces a new record to be read or written. This is the language's most serious defect on the TRS-80—it is impossible, for example, to position the cursor and write at a specific location without disturbing the rest of the screen."

While "Fortran Breakout" was a Model I/III article, our Fortran Extension Library (\$49.95) alleviates this difficulty on the Models II/12/16. I realize that this is a new addition to Fortran, but many readers have not

only seen our ad, but have purchased and used the program.

Pierre H. Charrin
The Proper Touch
P.O. Box 13760, #202
Houston, TX 77219

Model 4 Review

After reading Michael Vose's review of the Model 4 ("Once More With Feeling," August 1983, p. 100), I feel compelled to respond. As the primary designer of the TRSDOS 6.0 operating system, I feel qualified to address the following points.

Mr. Vose says that Model III software manufactured by companies other than Radio Shack might not run on the Model 4. Has he any that will not? Tandy exerted a tremendous effort to assure compatibility with its Model III.

The Model III contains three ROM chips that store the Level II Basic interpreter as well as device Input/Output (I/O) handlers. These ROMs are designated A, B, and C.

The Model 4 uses a newer type of video control that necessitates a small change in ROM C to initialize the video chip. When booted with a Model III operating system disk, this is the only difference in ROM appearance.

Logical Systems Inc. (licensor of TRSDOS 6.0) even requested that the old Model I printer memory map address of 37E8 hexadecimal still be addressable for the printer status input.

Mr. Vose says that the Model 4 bootstrap loader is different from the Model III's. Except for the ROM change associated with the video chip initialization, loading is the same. It is extremely difficult to imagine some protected program's loading method interfering with this change.

Concerning disk booting, when you turn on the Model 4 or press the reset button, the machine runs exactly like a Model III with 14K of ROM.

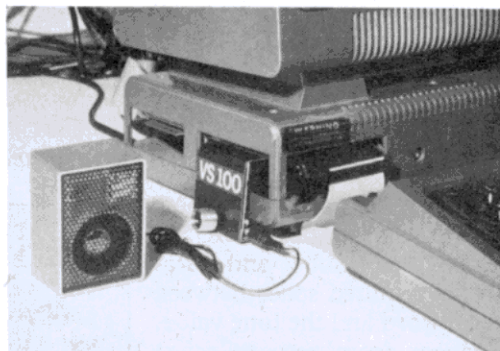
This ROM has a disk bootstrap loader that reads sector 1 of track zero into RAM. Sector 1 contains the secondary bootstrap loader common-

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ly called Boot/SYS. Thus, a Model III DOS disk boots exactly as it does on the Model III.

The Boot/SYS contained on a TRSDOS 6.0 DOS, however, has a secondary loader that switches in the full 64K RAM and converts the video control over to an 80-column by 24-line display.

This is accomplished by means of control bytes output to the memory management port. It is this secondary loader that reads in the entire track zero to load the device drivers.

Basic 6.0 drops the CMD reserved word, but substitutes SYSTEM in its place. Without cassette I/O from Basic, there is no need for SYSTEM to be associated with machine language tapes.

Also, although left out of the Radio Shack manual, Basic does support sound directly. The syntax is SOUND followed by tone number and duration with the required space between the reserved word and the tone value.

Tone ranges from zero to seven while duration ranges from zero to 31. The Quick Reference Card included with the Model 4 documentation shows the Sound reserved word in its table of reserved words. I don't recollect a Level II Basic reserved word, Rename, that Mr. Vose says was dropped.

Basic 6.0 includes Name, which allows you to rename files. A TRSDOS version 6.0.1 will be available to provide a memory size of 31932 when you enter Basic with FILES=0. This is approximately 3K greater than that available under TRSDOS 6.0, and stems from improved stack handling during video and keyboard memory management.

It is not true that you can only use MEMDISK/DCT to simulate a disk drive if the Model 4 is equipped with the full 128K of RAM. MEMDISK also allows the simulation of a disk drive in a portion of the upper 32K of standard RAM via a user option. Also, TAPE100 not only reads Model 100 tapes, but also writes them.

TRSDOS 6.0 is much more than an upgrade of LDOS 5.x. The 6.0 system is a low-memory resident DOS that is accessed by supervisor calls (SVCs). It is totally device-independent.

TRSDOS 6.0 offers complete compatibility of media with its forebears.

80 ALERT

Occasionally, 80 Micro receives letters from readers who have had difficulties with our advertisers. Most of the time, these problems are resolved to the satisfaction of all parties, but some problems appear to be insoluble.

As a service to readers and advertisers alike, 80 Alert will pinpoint distributors who cannot be reached, by readers or by our advertising department, for customer service. Anyone who has current information about a manufacturer or distributor mentioned in the column is welcome to write and update our data.

We have been unable to contact Hurricane Labs Inc. (5149 Moorpark Ave. Ste. 105, San Jose, CA 95129). The company's telephone numbers have been disconnected, and correspondence is being returned. So far, we have not been able to obtain any further information.

Soft Sector Marketing Inc. (P.O. Box 340, Garden City, MI 48135) has gone out of business. President Vic Andrews told 80 Micro on July 7 that the firm will sell its present inventory to pay creditors, and will answer mail inquiries through the end of this year.

We have been unable to contact E-Z Tax Inc. (2444 Moorpark, San Jose, CA 95128). All phone numbers are disconnected and we have received no reply by mail. No further information was available at press time.

Its command set is a superset of earlier systems.

True, it is a powerful, complex system; however, with no more effort than that spent to learn a sophisticated spreadsheet or word processing program, you can master TRSDOS 6.0.

Roy Soltoff
President, Misosys
P.O. Box 4848
Alexandria, VA 22303

P	Q	PEQVQ
1	1	1
1	0	0
0	1	0
0	0	1

P	Q	PIMPQ
1	1	1
1	0	0
0	1	1
0	0	1

Table 1. Truth tables for EQV and IMP.

Vose Responds

Kudos to Roy Soltoff for the additional information about the TRS-80 Model 4. His willingness to share these details further demonstrates my article's point that an open door policy regarding Radio Shack's products is ultimately to their credit.

It's nice to receive information from an insider; much of my original information came from several harried Radio Shack Computer Center employees at the Boston Computer Society's hectic Model 4/Model 100 introduction.

The Model 4 I reviewed for 80 Micro would not respond to the Sound command described by Mr. Soltoff. It's possible that the machine was defective. Nevertheless, I was unable to generate any sound. In addition, the absence from the Model 4 manual of a syntax description for the sound commands is another instance of its inadequacy.

In my review I listed Rename as a dropped keyword because I did not have access to an LDOS manual and couldn't remember if Rename was an LBASIC enhancement; the TRSDOS 6.0 manual lists Rename as an unsupported keyword.

I feel confident that 80 Micro will print a letter or article detailing the function of the Boolean operators IMP (implication) and EQV (equivalence). (Table 1 is a truth table for those of you who can't wait.)

TRSDOS 6.0 is not as easy to master as a sophisticated spreadsheet or word processor because of its confusing documentation. But my main objection to TRSDOS 6.0 is that it is

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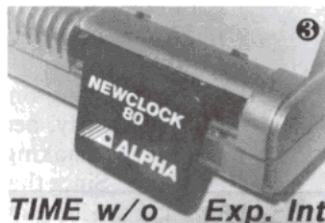
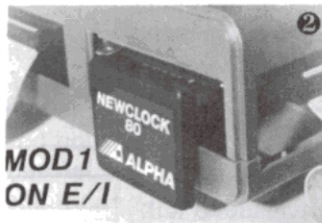


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Error Trap

In "Once More, With Feeling" (August 1983, p. 100), in the sidebar, "Semi-Custom Logic Circuits" (p. 106), the Model 4 is erroneously described as containing VLSI semi-custom logic chips. The sidebar should have read, "The Model 4 makes use of new, MSI (medium scale integration (over 1,000 transistors on a chip)) semi-custom logic chips."

In our "Buyer's Guide to CoCo Utilities" (July 1983, p. 212), Data Comp and Southeast Media Supply is omitted from the Company Name column under General Utilities. Data Comp (5900 Cassandra Smith Road, Hixson, TN 37343, 615-842-4601) markets the following products: Basic Precompiler (\$50), F-Mate FLEX Utilities (\$75), FLEX F-Mate (\$69.95), F-Mate FLEX Diagnostics (\$75), Four Drives From Two (\$19.95), and Terminal CoCo (\$19.95).

not an operating system that will appeal to a computer user.

Programmers may love it, but it's unnecessarily complex for the average person. My hope is that programmers can eventually design shells—or transparent operating systems like the Model 100's—to make learning a complex system program a thing of the past.

Finally, the program I couldn't load into the Model 4 was Adventure International's Sea Dragon.

G. Michael Vose
13 Mountain View Drive
Peterborough, NH 03458

CRT Radans Insignificant

In my article, "Making a Weak Link Stronger" (July 1983, p. 286), I omitted an item of some significance.

The Food and Drug Administration (FDA) study cited, in which some monitors were emitting X-rays at levels above the .5 microradans/hour standard, was done with machines

```
10 CLS:FOR X=15361 TO 15422:POKE X,131:NEXT
20 FOR X=16321 TO 16382:POKE X,176:NEXT
30 FOR X=15424 TO 16256 STEP64:POKE X,149:NEXT
40 FOR X=15487 TO 16319 STEP64:POKE X,170:NEXT
50 POKE 15360,151:POKE 15423,171:POKE 16320,181:POKE 16383,186
60 GOTO60
100 REM USE THE ABOVE PROGRAM TO DRAW A BOX ON YOUR CRT FOR
ALIGNMENT PURPOSES. INSIDE THE KEYBOARD CASE, ON THE RIGHT-
HAND SIDE, THERE ARE TWO POTENTIOMETERS (POTS) THAT YOU MUST
ACCESS TO MAKE ADJUSTMENTS TO THE VIDEO OUTPUT.
200 REM REMOVE THE SCREWS FROM THE BOTTOM OF THE KEYBOARD AND
LIFT THE TOP OF THE KEYBOARD CASE UP SO THAT THE POTS CAN BE
TURNED USING A SMALL SCREWDRIVER.
300 REM THE FRONT POT MOVES THE DISPLAY UP AND DOWN ON THE
CRT AND THE REAR POT MOVES IT RIGHT AND LEFT. ADJUST THE POTS
SO THAT THE SQUARE DRAWN BY THE PROGRAM IS WHERE YOU WANT IT
TO BE LOCATED.
400 REM I USED A SMALL, ROUND FILE TO MAKE SEMI-CIRCULAR HOLES
IN THE BOTTOM EDGE OF THE TOP HALF OF THE CASE, IN LINE WITH
EACH POT. THIS WAY, I DON'T NEED TO TAKE THE CASE APART TO MAKE
THESE ADJUSTMENTS.
500 REM SOMETIMES A JITTERY SCREEN CAN BE CURED BY SPRAYING A
CLEANER LIKE TUN-O-WASH OR SIMILAR TV TUNER CLEANER ON THESE
POTS AND ROTATING THEM BACK AND FORTH A FEW TIMES.
600 REM BE SURE TO TURN THE KEYBOARD OFF BEFORE USING THE SPRAY
CLEANER. GOOD LUCK.
```

Program Listing. Display repair.

operating under stress conditions, with line voltages at higher levels than are encountered during normal operation. The goal was to simulate an equipment malfunction to determine if terminals produce X-rays when they break down.

I was relying on a union report of the FDA study, because the FDA was no longer making the information available. Since that time, I've learned that the machines were made to fail.

The current state-of-the-art monitors emit so little radiation when properly operating as to be negligible. Of course, properly operating DC-10s don't fall out of the sky either. Wherever there's technology, there's the potential for failure—but the risk to terminal operators from X-rays, relative to current standards, is small.

Thomas Hartmann
South Garland St.
Plymouth, NH 03264

Display Adjustment

I wrote Program Listing 1 in response to Mr. Frank Denigan's request in Aid (August 1983, p. 24). Mr. Denigan's display on his Model I had moved up so it was hard to read the top line.

Many Model I users might not be aware of this simple procedure.

Chuck Webb
P.O. Box 338
Prairie Grove, AR 72753

Powersoft and Piracy

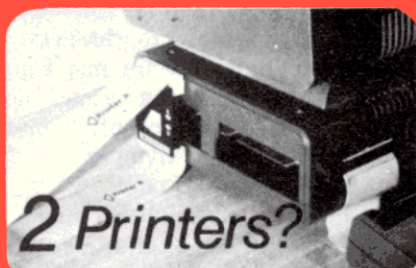
Roxton Baker's letter in Input (August 1983, p. 12) takes Powersoft to task for protecting their programs for the sole purpose of making a sale in any manner possible. Isn't the purpose of marketing to make a sale in any manner possible, as long as you don't misrepresent your product or defraud your customer? If the customer doesn't like the product, most companies will let him return the software for a refund.

I, too, wish that all protection schemes would go away and let me make copies of my programs, but I'm also realistic. Big Five Software, the Model I/III arcade-type program publisher, has decided to drop out of the market because program theft is high, and they can't sell enough copies of their programs to recoup their program developing and advertising investments. Their last release crossed the country on the stolen program circuit faster than UPS could deliver the programs to the stores.

I know a kid who went to computer camp and came back with a Model III disk loaded with arcade programs, including all the Big Five programs. He paid \$5 for the disk. About one hundred kids attended that computer camp. Not all these kids would have bought all the programs, but if each had bought only one program (instead of stealing 18), that would amount to a lot of sales.

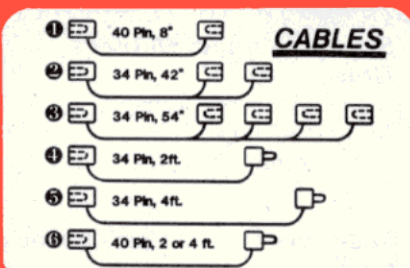
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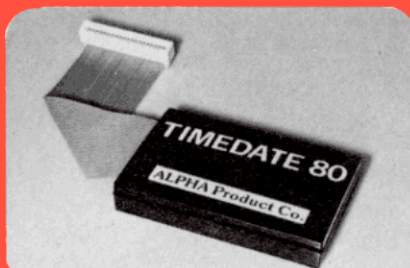


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GREEN SCREEN WARNING

IBM and all the "biggies" are using green screen monitors. Its advantages are now widely advertised. We feel that every TRS-80 user should enjoy the benefits it provides. But **WARNING:** all Green Screens are not created equal. Here is what we found:

- Several are just a flat piece of standard colored Lucite. The green tint was not made for this purpose and is judged by many to be too dark. Increasing the brightness control will result in a fuzzy display.
- Some are simply a piece of thin plastic film taped onto a cardboard frame. The color is satisfactory but the wobbly film gives it a poor appearance.
- One "optical filter" is in fact plain acrylic sheeting.
- False claim: A few pretend to "reduce glare". In fact, their flat and shiny surfaces (both film and Lucite type) ADD their own reflections to the screen.
- A few laughs: One ad claims to "reduce screen contrast". Sorry gentleman but it's just the opposite. One of the Green Screen's major benefits is to increase the contrast between the text and the background.
- Drawbacks: Most are using adhesive strips to fasten their screen to the monitor. This method makes it awkward to remove for necessary periodical cleaning. All (except ours) are flat. Light pens will not work reliably because of the big gap between the screen and the tube.

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 - The filter material that we use is just right, not too dark nor too light. The result is a really eye pleasing display.
- We are so sure that you will never take your Green screen off that we offer an unconditional money-back guaranty: try our Green Screen for 14 days. If for any reason you are not delighted with it, return it for a prompt refund.
- A last word: We think that companies, like ours, who are selling mainly by mail should list their street address have a phone number (for questions and orders) accept CODs, not every one likes to send checks to a PO box or the convenience of charging their purchase to major credit cards. How come we are the only green screen people doing it? Order your **ALPHA GREEN SCREEN** today...\$12.50

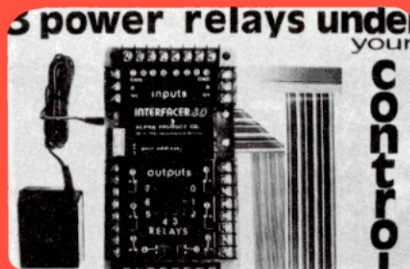


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User's Groups Update

80 Micro frequently receives information about user's groups from all parts of the country. The list below contains current information about these groups; it is arranged alphabetically by state.

Topeka Computer Club
c/o Kevin Cronister
2224 Hope
Topeka, KS 66614
913-272-1353

Southern Maine TRS-80 User's Group
c/o Anthony T. Scarpelli
82 Wellington Road
Portland, ME 04103

Kansas City TRS-80 User's Group
300 N.W. 83rd St.
Kansas City, MO 64118

Bug-80 User's Group
P.O. Box 62
Glen Gardner, NJ 08826

Midlands Computer Club
c/o Jerry Kilpatrick, President
P.O. Box 7594
Columbia, SC 29202

San Antonio TRS-80 User's Group
c/o Gerry Sharp, Secretary
14310 Pembridge, 782
San Antonio, TX 78247

Mid-Cities TRS-80 User's Group
c/o D.D. Freeman
334 Fieldside Drive
Garland, TX 75043
214-637-4510

Daltrug TRS-80 User's Group
c/o Bobra Shaeper
Rt. 2 Box 374-D2
Frisco, TX 75034
214-370-2432

Fort Worth TRS-80 User's Group
c/o Pat Coyne
2001 Beach St. #626
Fort Worth, TX 76103
817-429-7055

Dal-Cliff TRS-80 User's Group
c/o David Gattis
14523 Hague
Dallas, TX 75234
214-243-6764

If I had my way, software protection wouldn't exist because it wouldn't be necessary. But it is necessary. Some people can't seem to understand that good software takes time and money to develop. They assume that software magically appears for them to take and copy as they wish. I wrote software, but I couldn't make a living at it because more people had copies of my programs than my publisher sold.

It's a problem when software is protected to the point where I can't make back-ups, but I understand why it's protected. When I break the protection, I don't spread free copies around; I use them only for myself.

I'm indebted to WittSoft for their Super Utility Plus (SU+) back-up program, but that doesn't mean that I'm handing out duplicate programs to all my friends. SU+ is a very useful program and Kim Watt deserves his royalties.

Perhaps the solution is to make all software programs as cartridges. It would make them expensive, but the publisher would know the programs wouldn't be illegally copied, and the purchaser would know the program wouldn't self-destruct.

*Terry Kepner
P.O. Box 481*

Peterborough, NH 03458

Scriptit Part II Tips

Craig Lindley's article, "Inside Scriptit Part II" (October 1982, p. 276) is excellent. However, beware of these problems:

- Do not use the QD or Query function with NEWDOS.
- Never hit the break key when you are querying a directory in TRSDOS or your Model I goes nowhere.
- In line 2730, put four spaces behind the last asterisk or you'll get some surprises. Check the location where the buffer starts; if it is 8342 hexadecimal, then your program works.

*Jan Vromant
P.O. Box 1023
Monrovia, Liberia
West Africa*

Name Correction

My compliments to Alan Neibauer

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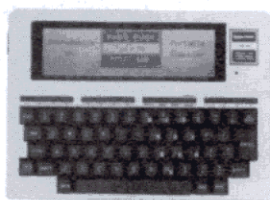
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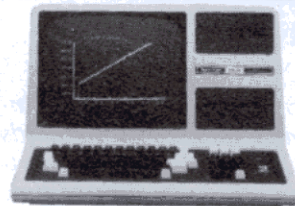
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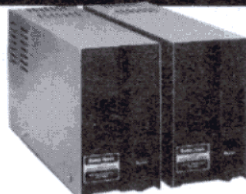
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Model IV 16K \$849
 Model IV 64K
 2 Disk & RS232 \$1699



CITOH Prowriter \$375
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DWP210 \$629

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w/64K ext. basic	305
Pocket Computer 2	165
Model 16B 1Dr 256K	4249
Model 16B 2Dr 256K	4915
Model 100 8K	679
Model 100 24K	835

MODEMS

Lynx II/III	235
Hayes Smartmodem II	235
Hayes Smartmodem 1200	565
Novation Smartcat 1200	459
Novation J-Cat	125
R.S. AC-3	129
R.S. Modem I	89

R.S. Modem II

R.S. DC-1200	565
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Silver Reed EXP500 D.W.	430
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DWP210	629
DWP410	1159
CGP115	159
DMP100	315
DMP120	395
DMP200	520
DMP400	1010
DMP500	1219
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ETC.

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C.C. Joysticks (pair)	22
16K Ram Chips	25
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Bulletin Board Update

80 Micro frequently receives information about bulletin boards from all parts of the country. Starting this month, from time to time we will publish bulletin board notices that we receive.

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919-758-5261

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011-834-5135

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Durban, South Africa
International dialing code 0027
031-66356

Cape Town Bulletin Board

Cape Town, South Africa
International dialing code 0027
021-457750

TRS-80 Country

Reseda, CA
213-996-1977
Model 100 software available

on his informative article, "A History of Programming Languages" (July 1983, p. 228). I would like to make one minor correction, however. Dr. Hooper's name is Captain Hopper; she is a retired U.S. Navy officer.

Ed Sargent
6431 W. 74 Ave.
Arvada, CO 80003

STAR-DOS Review

I would like to thank Scott Norman for his favorable review of STAR-DOS (April 1983, p. 54). However, Mr. Norman tends to make STAR-

DOS look like a poor cousin to a true operating system when it is in fact a true operating system.

STAR-DOS comes in two versions: one for systems with 16K or 32K RAM, and the other for systems with 64K RAM. Neither version prevents the use of alternative, high-level languages.

Also, STAR-DOS places no limitations on the Assembly-language user at all. Since the Color Computer is unique in running Basic programs without additional DOS, this placement also avoids any conflict with Basic.

Peter A. Stark
STAR-Kits
P.O. Box 209
Mt. Kisco, NY 10549

AIDS III Correction

In my AIDS III articles (March 1983, p. 136, and April 1983, p. 168), pressing the up-arrow key produces a left bracket instead of skipping back to the previous entry line. This is because the program checks whether the key is within a valid range of characters.

To eliminate this problem, make the following changes to the AIDS III, MAPS III, and CALCS III programs:

Boot up the AIDS III program and change line 170 to:

```
170 IF INSTR(CCS,K$)>0 THEN 200:
REM*** CHECK FOR CONTROL KEY
```

Then save the program back to disk.

To correct MAPS III, load the program and change line 930 to:

```
930 IF INSTR(CCS,K$)>0 THEN 1000:
REM*** CHECK FOR CONTROL KEY
```

Save the corrected program to disk.

Boot up the CALCSIII program and change line 12 to:

```
12 GOSUB 8: IF INSTR(CCS,K$)>0 THEN
18: REM*** CHECK FOR CONTROL
KEY
```

Next save the program to disk.

• Robert A. Fiorelli
Softrends Inc.
26111 Brush Ave.
Euclid, OH 44132

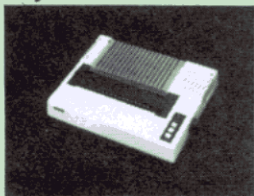
Glossary

Below is a glossary of acronyms frequently used in 80 Micro.

ASCII	American Standard Code for Information Interchange. Character code that refers to the computer's internal recognition of letters, numbers, and symbols.
CP/M	Control Program/Monitor or Control Program for Microcomputers. A disk operating system produced by Digital Research.
CPU	Central Processing Unit. Computer module that retrieves, decodes, and executes instructions.
CRT	Cathode Ray Tube. The television tube used to display pictures or characters.
DIP	Dual In-line Package. A standard integrated circuit package with two rows of pins at 1/10-inch intervals.
DOS	Disk Operating System, such as DOSPLUS, NEWDOS80, TRSDOS, and LDOS.
EPROM	Erasable Programmable Read Only Memory. Usually refers to a PROM that can be reused several times. It's erased with ultraviolet light and then programmed with a special PROM programmer.
K	Kilobytes. 1K = 1024 bytes. Used in referring to computer storage capacity.
RAM	Random Access Memory. This is the primary storage area of a computer. The information in RAM is lost when power is disconnected.
ROM	Read Only Memory. This information cannot be changed and is not lost when the power is off.

EPSON

FX, RX & MX



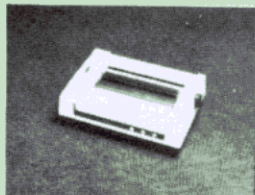
The **FX-80** features 160 cps, a correspondence font, 10, 12 & 17 cpi, italics, double-strike/width/emphasis, etc., dot graphics, friction/pin feed (the adjustable tractor is optional) & a 2K buffer. The 256 programmable characters use the 2K buffer space. The **FX-100** is the 136 column version & includes an adjustable tractor.

The **RX Series** replaces the MX, & offers 100 cps print speeds, but nothing more remarkable.

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FX-100.....	\$769.88

C. ITOH

Prowriter

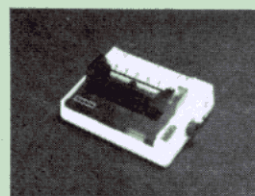


C. Itoh's venerable **Prowriter** has speed (120 cps), a buffer (1.5K), 10, 12, & 16 cpi (plus a proportional font with correspondence quality) and dot graphics (160x144 dpi). The **Prowriter 2** is the 136 column version.

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STAR MICRONICS

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The **Gemini 10X** features 120 cps, 10, 12, 17 cpi, italics, a correspondence font, dot graphics & a 1K buffer. Friction/tractor feed. Use plain spool ribbons. The **Gemini 15** is the 132 column version. The

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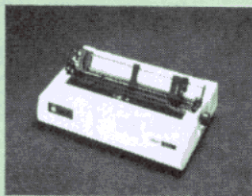
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The **Microline 84** (132 col) is the Step 2 version, featuring 200 cps at 10, 12, & 17 cpi (w/double-width), all with a correspondence mode & dot addressable graphics. Parallel interface are standard issue.

The **Microline 82A** is a data cruncher, with 120 cps, 10 & 17 cpi, double-width, friction/pin feed on 80 columns. The **Microline 83A** is the 136 column version. Dot-addressable graphics are optional. Microline 82A..... \$389.88 82A/92 Tractor..... \$59.88 Microline 83A..... \$599.88 Okigraph I Dot Graphics ROM (82A/83A)..... \$49.88 Microline 92..... \$459.88 Microline 93..... \$759.88 Microline 84..... \$1024.88



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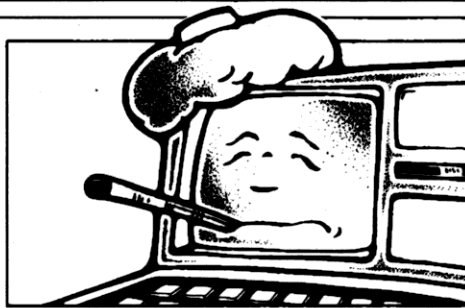
Has anyone developed an RTTY program for the Color Computer using the Baudot Code for input and output? A copy of this program would save me weeks of work.

B. Kevin McCarthy
U.S. Coast Guard Loran Station
St. Paul Island, AK 99660

A Protective Case

I'm searching for a protective case for my Color Computer keyboard so that I can use it with hotel systems on trips. Does anyone know where I can find such a case?

Stan Williams
Route 1, Box 94-70
Manakin-Sabot, VA 23103



Searching for answers

Transferring Profile

Our organization has several large Profile files that we'd like to convert to Profile III Plus without having to

reenter all the data. We would appreciate any information on a Basic Model III program that would allow such a transfer.

Richard J. Paul
Regional Emergency
Communications Network
1200 Meadowdale Drive
Carpentersville, IL 60110

New Features

I'd like to hear from anyone who has found a way to add a sort verb, a search verb, and exponentiation to RSCOBOL for the Model I with NEWDOS80.

Jeff Carver
P.O. Box 1049
APO, NY 09063

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What Is It?

In the Program Listings for J.B. Harrell's "A Pascal Primer" (July 1983, p. 94), you can easily mistake the lowercase l's for numeral 1's. If you encounter problems in determining whether you should enter a number or letter, contact our technical department. They will provide you with a clearly marked program listing.

For those of you contemplating submitting a Pascal article for publication, please do not use the letter l as a variable. Thanks.—Eds.

Better Solutions

I found and fixed some bugs in Wayne Thume's "Better CoCo Graphics" program listing (June 1983, p. 164).

First, in line 1170, change the "P" to an "S". This is the line that checks to see if the key you pressed is the one to set a point, which is S. The new line should read:

```
1170 IF CBS="S" THEN CC=1:PSET
      (LL+JJ,MM+KK)
```

If you try to transfer a section on either the extreme left line or the ex-



Flaws and fixes

treme top line, you'll get an Illegal Function Call error. This is because the computer tries to get and put points at coordinate -4. Removing the -4's from lines 260, 300, 310, and 380 fixes this bug without changing the transfer block.

Andy Dater
2847 La Mirada
Medford, OR 97501

Try It My Way

The debug to the OV error in line 1160 of Lee Morgenstern's "Dual-Voice Music Synthesizer" (June 1983,

p. 22) is not recommended. Instead, rewrite line 1160 to read: 1160 READ Q: PRINT Q; POKE P,Q: P=P+1: NEXT and add line 1035 to read: 1035 POKE16553,255. Some Model I's won't read data statements properly after cassette I/O. Instead, they execute a Restore command before each Read statement. The above line revisions and additions take care of this problem.

Rob Rosenbrock
1215 Echo Lane
Bluffton, IN 46714

Put an End to It All!

There's a problem with Program Listing 4 in Philip Martel's "La Plume de Ma Tante" article (July 1983, p. 78). The program doesn't end since line 430 does not allow entry of number values greater than 19 but line 380 requires a number value of 99 to end the program. To correct this problem, reenter line 420 as both 365 and 465, and then remove line 420 altogether.

Oscar Abraham
955 East 12th St.
Brooklyn, NY 11230

Sketchpad Line!

A line is missing in Larry Colle's "Color Sketchpad" program listing (June 1983, p. 110). The missing line to be added is:

```
95 IFAS="P" THEN PAINT(X+3,Y)
      ,C,C:F=C
```

—Eds.

Misdeal

The following lines are missing from Program Listing 4 of Byron Lott's "Model II Casino" article (August 1983, p. 148).

```
NTCHR$(1);:RETURN
1240 PRINTCHR$(2);:L=683:GOSUB
1230:RX=R6:GOSUB1160:TS=MS
(R6):GOSUB1200:PRINTCHR$(1);:
RETURN
```

—Eds.

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CDP

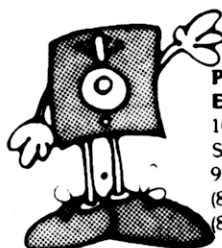


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Not long ago, a friend was modifying a complex Basic program he had written. He needed a new variable for his modification but couldn't remember which variable names he had already assigned and he didn't feel like wading through pages of program listings to find out what he had used. This month, I'll describe a solution to this problem.

Whether or not you want a utility that displays currently active variables, you should find the memory structures and ROM routines I'll discuss useful for many programming projects.

TRSDOS 1.3 has a weak CMD "X" function to search for variable names, but it doesn't differentiate between a variable and a literal string. However, with the use of low memory pointers, a knowledge of how Basic stores variables, and some help from ROM rou-



Displaying active variables

times, you can easily create your own programmer's utility to display all current variables and arrays.

The lowest section of general-purpose RAM, from 4000 hexadecimal (hex) up, is reserved for use by Basic. This area contains the restart vectors, device control blocks, and a wide range of buffers, pointers, and temporary values. Though the Models I and III handle parts of this region of RAM differently, most of it is the same on the two machines. They also construct identical tables of variables during execution of Basic programs.

Figure 1 shows the general layout of memory. Except for ROM, the screen and keyboard, and the reserved low memory area, everything in the memory map is movable. Basic keeps track of it all with pointers; the values at the side of the map show these pointers' locations. The Basic interpreter is flexible enough to let each section of the map be any required size (until memory is full). It only needs to keep track of the various areas by adjusting its own pointers.

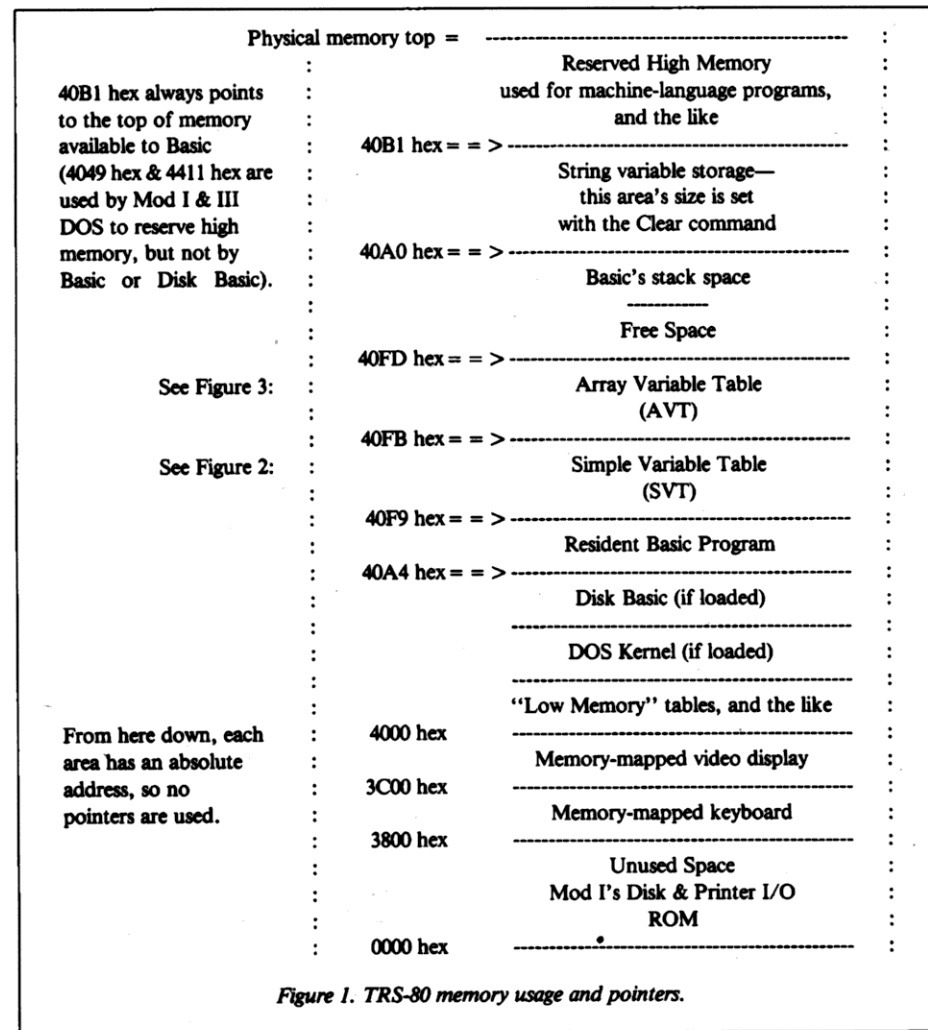
Of interest this month are the simple variable table (SVT) and array variable table (AVT). Both tables are built and filled during execution of a Basic program; both are obliterated (i.e., the pointers set to "no table length") during programming, editing, and with the Run and Clear commands.

Whenever your computer encounters a new simple variable in a program, it checks free space, moves the AVT up in memory to make room for the variable, adds the variable to the end of the SVT, and adjusts the pointers. When the computer encounters a new array variable, it checks free space, adds the array to the end of the AVT, and adjusts the pointers. In both cases, Basic must first scan all the variables already in the tables to decide if you're using an old or new variable.

Figure 2 shows the structure of each entry in the SVT. The first byte of each variable entry is a code that identifies the variable type and equals the length of that entry after the 3-byte header:

- 2 represents an integer variable (%)
- 3 represents a string variable (\$)
- 4 represents a single-precision variable (!)
- 8 represents a double-precision variable (#)

After the variable-type code, 2 bytes



show the variable's name, but in reversed order. For example, CA% would be represented as "2 A C." The names of numeric variables are followed by their values. The names of string variables are followed by 3 bytes indicating the string length and its location in either the program (for a literal string) or high memory.

The structure of the AVT is somewhat different (see Fig. 3). The first 3 bytes of each entry are the same as in the SVT: type code and reversed variable name. Bytes 3 and 4 contain a 2-byte offset which, when added to the address of byte 5, points to the next array variable entry in the table. Byte 5 holds the number of dimensions in the array.

Following byte 5 are values showing the maximum size of each dimension index plus one; however, the first size indicator is for the dimension index at the extreme right and the last indicator is for the one at the extreme left. Finally, the actual values are stored. Basic must calculate the location of each array element from the above information be-

Program Statement	Memory Location	Hex Value	Comment
AB% = 1			
	6715 hex	02	Type Marker (40F9 hex points here)
		42	2nd letter of name (B)
		41	1st letter of name (A)
		01	Value
	6719 hex	00	Value (expressed as integer)
CS = "THE NEXT STEP"			
	671A hex	03	Type Marker
		00	No second letter in name
		43	1st letter of name (C)
		0D	String length (13 characters)
		DB	Location of string
	671F hex	66	in memory (66CF hex)
FLAG! = 1			
	6720 hex	04	Type Marker
		4C	2nd letter of name (L)
		46	1st letter of name (F)
		00	Value
		00	Value
		00	Value
	6726 hex	81	Value (expressed as single-precision value)

Figure 2. Examples of Basic's technique for storing simple variables.

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THE NEXT STEP

Program Statement	Memory Location	Hex Value	Comment
-------------------	-----------------	-----------	---------

DIM XY%(1,2,3)

6727 hex	02	Type Marker (40FB hex points here)
	59	2nd letter of name (Y)
	58	1st letter of name (X)
	37	Offset to next array
	00	(672C hex + 0037 hex = 6763 hex)
672C hex	03	Number of dimensions
	04	Maximum value of right-most index + 1
	03	Maximum value of middle index + 1
	02	Maximum value for left-most index + 1
	00	Space for values
		(2*3*4*2 = 48 spaces)

DIM Z\$(5)

6763 hex	03	Type Marker
	00	No second letter in name
	5A	1st letter of name (Z)
	15	Offset to next array
	00	(6786 hex + 0015 hex = 677D hex)
6768 hex	01	Number of dimensions
	06	Maximum value for index + 1
	00	Space for values
		(6*3 = 18 spaces)
677D hex		Beginning of free space (40FD hex points here)

Figure 3. Examples of Basic's technique for storing array variables.

cause no other marker bytes are in the array.

The three important pointers for handling variables are stored at successive locations:

40F9 hex points to the SVT
40FB hex points to the AVT
40FD hex points to the beginning of free space

Because space is never wasted in either the SVT or AVT, the pointer at 40FB hex also indicates the end of the SVT, and the one at 40FD hex indicates the end of the AVT.

Armed with the structure of the SVT and AVT, as well as their related pointers, you should have little trouble following this month's program (see Program Listing). Any time you press the shift, down-arrow, and V keys simultaneously, the program displays all active simple variables and all active arrays. The array display includes the

maximum index values for each dimension.

The first block of the program, lines 590-670, is similar to the SETUP routine in my August column (p. 30). It hooks the program into the keyboard driver (unless it is already there) and protects the program in memory. Then control returns to either DOS or Basic.

The second block, Test, interrupts every call to the keyboard driver to see if you pressed the appropriate keys. If not, control passes to the regular keyboard driver. If you press the shift, down-arrow, and V keys, the variable display program takes control. These first two sections should look familiar to regular readers.

Actual processing begins in line 870 with a call to the subroutine PUSHAL, which saves all current registers, except AF, to the stack. Then the program saves the screen and the current cursor position. By the end of this block of



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THE NEXT STEP

code, the program saves everything needed to return to a running program either in buffers or on the stack. Finally, the program calls the ROM routine at 01C9 hex to clear the screen, and the cursor is moved toward the bottom of the screen.

The fourth program block, starting on line 1010, establishes three pointers: IX points to the simple-variable table, HL points to the present screen location, and IY indexes a table of variable-type indicators. The program maintains these three pointers throughout the simple-variable section of the program.

The main loop of the simple-variable display starts with VAR10 is line 1040. First, the program compares the AVT pointer with the present value of IX to determine if all simple variables are displayed. The RST 18 hex instruction calls a ROM routine that performs a 16-bit compare of HL and DE and sets the status flags accordingly. If DE is larger than HL, the carry flag is set to indicate that more simple variables have to be displayed; otherwise, control passes to the array-variables display.

In line 1120, the program loads the B register with the variable's type code. Then the A register picks up the variable name and displays it on the screen at the present HL position. If the variable has a single-letter name, the place for the second letter in the SVT will contain a zero which the program won't display. After the name, the program needs to display the variable's type symbol: %, \$, !, or #. It finds the symbol by using the IY pointer plus an offset based on the present value in B. The Z80 chip doesn't support this kind of indirect indexing, but the indexing is a powerful tool in many programs.

After the computer displays the variable and its type symbol, it updates the IX and HL registers and checks HL. If it finds the current line full, it adjusts HL to point to the next line. If the screen is full, the program waits for you to press the enter key before it continues. Otherwise, the loop repeats and the program displays the next simple variable.

The array-variables display works a little differently. IX is still used as a pointer to the array table (now the AVT), but instead of using HL to point to the screen, the program uses the regular ROM display routine at 033A hex. The advantages are that ROM determines print positions and you can use

Program Listing. Current variables display.

```

00100 ;*****
00110 ;
00120 ; Current Variable Display
00130 ;
00140 ; On <Shift> <Dwn-arrow> <V>
00150 ; shows two screens (or more)
00160 ; 1st -- all defined, simple
00170 ; variables
00180 ; 2nd -- all defined array
00190 ; variables
00200 ;
00210 ;*****
00220 ;
00230 ;
00240 ;Listing of routines and addresses:
00250 ;
033A 00260 PRINT1 EQU 033AH ;PRINT 1 CHAR.
2B75 00270 PRINT EQU 2B75H ;PRINT STRING
01C9 00280 CLS EQU 01C9H ;CLEAR SCREEN
0A9A 00290 HLACUM EQU 0A9AH ;HL==> RAM ACCUMULATOR
0ACC 00300 ACINSN EQU 0ACCH ;ACCU. VALUE INT->SINGLE
0FBD 00310 ACUSTR EQU 0FBDH ;ACCU => ASCII STRING
00320 ;
4016 00330 KBDVR EQU 4016H ;KB DRIVER ADDRESS
4020 00340 CURSAD EQU 4020H ;CURSOR POSITION ADDRESS
00350 ;
3804 00360 ROW3 EQU 3804H ;P-W KEYBOARD ROW
3840 00370 ROW7 EQU 3840H ;ENTER & ARROWS KB ROW
3880 00380 ROW8 EQU 3880H ;SHIFT KEYBOARD ROW
00390 ;
3C00 00400 VIDEO EQU 3C00H ;TOP OF SCREEN
3FBB 00410 ENDDSP EQU 3FBBH ;LAST LINE FOR DISPLAY
3FC8 00420 PRTPOS EQU 3FC8H ;ADDR. FOR PROMPT DISPLAY
00430 ;
4411 00440 MEMTOP EQU 4411H ;MEMTOP FOR MOD.III DISK
00450 ; use 4049H for MODI Disk, 40B1H for tape systems
00460 ;
40F9 00470 SVT EQU 40F9H ;BEG. OF VARIABLE LIST
40FB 00480 AVT EQU 40FBH ;BEG. OF ARRAY LIST
40FD 00490 FREE EQU 40FDH ;BEG. OF FREE SPACE
00500 ;
00510 ;
00520 ; First, patch routine into keyboard
00530 ; driver, being careful to save current
00540 ; driver address, and reset MEMTOP.
00550 ;
BA52 00560 ORG 0BA52H ;CHANGE ORG TO RELOCATE
00570 ; this address for top of 32K RAM
00580 ;
BA52 2A1640 00590 SETUP LD HL,(KBDVR) ;GET CURRENT DRIVER ADDR.
BA55 116ABA 00600 LD DE,TEST ;GET ROUTINE ADDR.
BA58 DF 00610 RST 18H ;COMPARE DE & HL
BA59 280C 00620 JR Z,SET10 ;GO IF ALREADY SET
BA5B 227DBA 00630 LD (RETURN+1),HL ;SET RETURN ADDR.
BA5E ED531640 00640 LD (KBDVR),DE ;SET 'TEST' AS KB DRIVER
BA62 1B 00650 DEC DE ;DE=TEST-1
BA63 ED531144 00660 LD (MEMTOP),DE ;SET MEMTOP
BA67 C32D40 00670 SET10 JP 402DH ;RETURN TO DOS
00680 ;
00690 ; Line 670 should be JP 1A19H for tape systems
00700 ;
00710 ; Now test for <SHIFT> <DOWN-ARROW> <V>
00720 ;
BA6A 3A4038 00730 TEST LD A,(ROW7) ;GET DWN-ARW ROW
BA6D E610 00740 AND 10H ;IS IT DWN-ARW?
BA6F 280B 00750 JR Z,RETURN ;GO IF NOT
BA71 3A0038 00760 LD A,(ROW8) ;GET SHIFT ROW
BA74 B7 00770 OR A ;SET FLAGS
BA75 2805 00780 JR Z,RETURN ;GO IF NO SHIFT KEY
BA77 3A0438 00790 LD A,(ROW3) ;GET P-W ROW
BA7A E640 00800 AND 40H ;CHECK FOR V
BA7C CA0000 00810 RETURN JP Z,0000H ;SETUP PUTS VALUE HERE
00820 ;
00830 ; <shift> <down-arrow> <V> have been pressed.
00840 ; Save all registers.
00850 ; Save screen & then clear it.
00860 ;
BA7F CD92BB 00870 CALL PUSHAL ;SAVE ALL REGISTERS
BA82 11FE8B 00880 LD DE,SCRBUF ;DE==> SCREEN BUFFER
BA85 21003C 00890 LD HL,VIDEO ;HL==> SCREEN
BA88 010004 00900 LD BC,400H ;BC = SCREEN LENGTH
BA8B EDB0 00910 LDIR ;MOVE SCREEN
BA8D 2A2040 00920 LD HL,(CURSAD) ;GET CURRENT CURSOR ADDR.
BA90 22FEBF 00930 LD (CRSBUF),HL ;AND SAVE IT ALSO
BA93 CDC901 00940 CALL CLS ;CLEAR THE SCREEN
BA96 21C83F 00950 LD HL,PRTPOS ;GET PRINT POSITION
BA99 222040 00960 LD (CURSAD),HL ;MOVE CURSOR AWAY
00970 ;
00980 ; Now get list of simple (not array) variables and print
00990 ; each on the screen.
01000 ;
BA9C DD2AF940 01010 LD IX,(SVT) ;IX==>VARIABLE LIST
BAA0 21003C 01020 LD HL,VIDEO ;HL==> SCREEN
BAA3 FD21F7BB 01030 LD IY,TYPES ;IY==> VAR. TYPE TABLE
BAA7 E5 01040 VAR10 PUSH HL ;SAVE SCREEN PTR.
BAA8 D0E5 01050 PUSH IX ;MOVE VAR. LIST PTR
BAAA E1 01060 POP HL ; TO HL
BAAB ED5BF840 01070 LD DE,(AVT) ;GET END OF VAR. TABLE
BAAF DF 01080 RST 18H ;CP HL:DE
BAB0 E1 01090 POP HL ;RECOVER SCREEN PTR.

```

Listing continued

Listing continued

```

BAB1 303E      01100      JR      NC,ARRAY      ;GO IF NO MORE VARIABLES
                01110      ;
BAB3 DD4600    01120      LD      B,(IX)      ;GET VARIABLE TYPE
BAB6 DD7E02    01130      LD      A,(IX+2)    ;1ST LETTER OF VAR. NAME
BAB9 77        01140      LD      (HL),A      ;PRINT IT
BABA 23        01150      INC     HL          ;BUMP POINTER
BABB DD7E01    01160      LD      A,(IX+1)    ;2ND LETTER OF VAR. NAME
BABE B7        01170      OR      A          ;SET FLAGS
BABF 2802      01180      JR      Z,VAR20     ;GO IF ZERO
BAC1 77        01190      LD      (HL),A      ;ELSE PRINT IT
BAC2 23        01200      INC     HL          ;AND BUMP POINTER
BAC3 78        01210      LD      A,B         ;GET VARIABLE TYPE
BAC4 3D        01220      DEC     A          ;DECREASE BY TWO TO
BAC5 3D        01230      DEC     A          ;ALIGN WITH TABLE
BAC6 32CBB8    01240      LD      (IYPTR+2),A ;USE FOR OFFSET
BAC9 FD7E00    01250      IYPTR LD      A,(IY+0) ;GET TYPE SYMBOL
BACC 77        01260      LD      (HL),A      ;PUT ON SCREEN
BACD 23        01270      INC     HL          ;BUMP POINTER
BACE 23        01280      INC     HL          ;AND AGAIN FOR SPACE
                01290      ;
BACF DD23      01300      INC     IX          ;GET PAST HEADER
BAD1 DD23      01310      INC     IX          ;WITH THREE
BAD3 DD23      01320      INC     IX          ;INCREMENTS
BAD5 DD23      01330      INC     IX          ;MOVE PAST VAR. INFO
BAD7 10FC      01340      DJNZ    VAR30      ;DEPENDING ON VAR. TYPE
                01350      ;
                01360      ;Check screen
BAD9 11BB3F    01370      LD      DE,ENDDSP ;LAST PRINT POS.
BADC DF        01380      RST      18H       ;CP HL:DE
BADD D4A4BB    01390      CALL    NC,ENDSCR ;GO IF SCREEN FULL
BAE0 7D        01400      LD      A,L       ;GET LSB OF SCREEN PTR.
BAE1 E63F      01410      AND     3FH       ;MASK BITS 6 & 7
BAE3 FE3C      01420      CP      3CH       ;END OF LINE?
BAE5 38C0      01430      JR      C,VAR10    ;RETURN IF NOT
BAE7 114000    01440      LD      DE,40H    ;LINE OFFSET
BAEA 19        01450      ADD     HL,DE     ;HL=> NEXT LINE
BAEB 7D        01460      LD      A,L       ;GET LSB
BAEC E6C0      01470      AND     0C0H     ;MASK OUT BITS 0-5
BAEE 6F        01480      LD      L,A     ;HL=> START OF NEXT LINE
BAEF 18B6      01490      JR      VAR10     ;GET ANOTHER VARIABLE
                01500      ;
                01510      ;Now show arrays
                01520      ;
BAF1 CDA4BB    01530      ARRAY CALL    ENDSR   ;NEW SCREEN FOR ARRAYS
BAF4 DD2AFB40  01540      LD      IX,(AVT)  ;IX==>ARRAY TABLE
BAF8 DDE5      01550      ARR10 PUSH    IX    ;TRANSFER PTR TO
BAFA E1        01560      POP     HL       ;TO HL
BAFB ED5BFD40  01570      LD      DE,(FREE) ;DE==>END OF ARRAYS
BAFF DF        01580      RST      18H       ;CP HL:DE
BB00 3075      01590      JR      NC,DONE   ;GO IF END OF TABLE
                01600      ;
BB02 DD4600    01610      LD      B,(IX+0)  ;GET VARIABLE TYPE
BB05 DD7E02    01620      LD      A,(IX+2)  ;1ST LETTER OF VAR. NAME
BB08 CD3A03    01630      CALL    PRINT1  ;PRINT A
BB0B DD7E01    01640      LD      A,(IX+1)  ;2ND LETTER OF VAR. NAME
BB0E B7        01650      OR      A          ;SET FLAGS
BB0F 2803      01660      JR      Z,ARR20   ;GO IF 0
BB11 CD3A03    01670      CALL    PRINT1  ;ELSE PRINT IT
BB14 78        01680      LD      A,B       ;GET VAR. TYPE VALUE
BB15 3D        01690      DEC     A          ;SUBTRACT TWO TO
BB16 3D        01700      DEC     A          ;ALIGN WITH TABLE
BB17 321CBB    01710      LD      (IYPTR2+2),A ;ADDRESS TABLE
BB1A FD7E00    01720      IYPTR2 LD      A,(IY+0) ;GET TYPE SYMBOL
BB1D CD3A03    01730      CALL    PRINT1  ;AND PRINT IT
BB20 3E28      01740      LD      A,'('    ;PAREN. CHAR.
BB22 CD3A03    01750      CALL    PRINT1  ;AND PRINT IT
                01760      ;
BB25 DD4E05    01770      LD      C,(IX+5)  ;GET # OF DIMENSIONS
BB28 DD5E03    01780      LD      E,(IX+3)  ;DE WILL HAVE OFFSET
BB2B DD5604    01790      LD      D,(IX+4)  ;TO NEXT ARRAY
BB2E DDE5      01800      PUSH    IX       ;TRANSFER IX VALUE TO
BB30 E1        01810      POP     HL       ;HL REGISTER
BB31 19        01820      ADD     HL,DE   ;ADD OFFSET
BB32 110500    01830      LD      DE,5    ;OFFSET FOR HEADER
BB35 19        01840      ADD     HL,DE   ;HL=> NEXT ARRAY
BB36 E5        01850      PUSH    HL       ;SAVE ADDRESS
                01860      ;
BB37 0606      01870      LD      B,6     ;BUMP IX 6 TIMES
BB39 DD23      01880      ARR30 INC     IX       ;SO IX=> SIZE OF
BB3B 10FC      01890      DJNZ    ARR30    ;1ST DIMENSION
                01900      ;
BB3D 41        01910      LD      B,C     ;GET # OF DIM.
BB3E CB20      01920      SLA      B        ;MULTIPLY BY TWO
BB40 DD23      01930      ARR40 INC     IX       ;BUMP POINTER
BB42 10FC      01940      DJNZ    ARR40    ;UNTIL PAST DIM SIZES
                01950      ;
BB44 41        01960      LD      B,C     ;GET # OF DIM. AGAIN
BB45 DD2B      01970      ARR50 DEC     IX       ;DROP IX UNTIL IT
BB47 DD2B      01980      DEC     IX       ;POINTS TO NEXT DIM.
BB49 DD6E00    01990      LD      L,(IX+0) ;GET LSB OF DIM SIZE
BB4C DD6601    02000      LD      H,(IX+1) ;AND MSB
BB4F 2B        02010      DEC     HL       ;CORRECT FOR 0 ELEMENT
BB50 CDCEBB    02020      CALL    ASCPRT ;PRINT AS ASCII
                02030      ;
BB53 3E2C      02040      LD      A,', ' ;GET COMMA CHAR.
BB55 CD3A03    02050      CALL    PRINT1 ;AND PRINT IT
BB58 10EB      02060      DJNZ    ARR50 ;REPEAT FOR ALL DIM.S
                02070      ;
BB5A 212040    02080      LD      HL,CURSAD ;HL=>CURSOR POS'N
BB5D 35        02090      DEC     (HL)    ;MOVE BACK OVER LAST ", "
BB5E 3E29      02100      LD      A,', ' ;GET CLOSE PAREN.
BB60 CD3A03    02110      CALL    PRINT1 ;AND PRINT IT

```

Listing continued

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THE NEXT STEP

Listing continued

```

BB63 3E20      02120      LD      A,' '      ;NOW AN ASCII SPACE
BB65 CD3A03     02130      CALL     PRINT1    ;AND PRINT IT
BB68 2A2040     02140      LD      HL,(CURSAD) ;GET CURSOR POS'N
BB6B 11BB3F     02150      LD      DE,ENDDSP  ;END OF PRINT AREA
BB6E DF         02160      RST      10H      ;CP HL:DE
BB6F D4A4BB     02170      CALL     NC,ENDSCR ;GO IF SCREEN FULL
                   02180 ;
BB72 DDE1       02190      POP      IX      ;IX==> NEXT ARRAY
BB74 C3F8BA     02200      JP      ARRI0     ;GO TO WORK ON IT
                   02210 ;
BB77 CDA4BB     02220      CALL     DONE      ;ASK FOR ENTER
BB7A 21FEBB     02230      LD      HL,SCRBUF  ;HL==>SCREEN BUFFER
BB7D 11003C     02240      LD      DE,VIDEO  ;DE==>SCREEN
BB80 010004     02250      LD      BC,400H    ;BC = SCREEN LENGTH
BB83 EDB0       02260      LDIR                     ;MOVE TO SCREEN
BB85 2AFEBF     02270      LD      HL,(CRSBUF) ;GET OLD CURS. POS'N
BB88 222040     02280      LD      (CURSAD),HL ;AND RESTORE IT
BB8B CD9BBB     02290      CALL     POPAL     ;RESTORE REGISTERS
BB8E AF         02300      XOR      A        ;A & Z-FLAG SHOW 0
BB8F C37CBA     02310      JP      RETURN    ;RETURN TO BASIC
                   02320 ;
BB92 E3         02330      PUSHAL   (SP),HL    ;HL ON STACK; SAVE RET
BB93 C5         02340      PUSH     BC        ;SAVE ALL REGS
BB94 D5         02350      PUSH     DE
BB95 DDE5       02360      PUSH     IX
BB97 FDE5       02370      PUSH     IY
BB99 E5         02380      PUSH     HL
BB9A C9         02390      RET                      ;ORIG. RET ADDR.TO STACK
                   02400 ;
BB9B E1         02410      POPAL    POP      HL    ;GET RET. ADDR.
BB9C FDE1       02420      POP      IY        ;RESTORE ALL REGS.
BB9E DDE1       02430      POP      IX
BBA0 D1         02440      POP      DE
BBA1 C1         02450      POP      BC
BBA2 E3         02460      EX      (SP),HL   ;GET ORIG. HL
BBA3 C9         02470      RET
                   02480 ;
                   02490 ;
BBA4 CD92BB     02500      ENDSCTR CALL     PUSHAL   ;SAVE REGS.
BBA7 21C83F     02510      LD      HL,PRTPOS  ;HL=PRINT POS'N
BBA8 222040     02520      LD      (CURSAD),HL ;MAKE CURSOR POS'N
BBA9 21E4BE     02530      LD      HL,MSG     ;HL==> MESSAGE
BBB0 CD752B     02540      CALL     PRINT     ;PRINT MESSAGE
BBB3 CDC0BB     02550      CALL     GETENT    ;GET ENTER KEY
BBB6 CDC901     02560      CALL     CLS       ;ROM CLS ROUTINE
BBB9 CD9BBB     02570      CALL     POPAL     ;RESTORE REGS.
BBBC 21003C     02580      LD      HL,VIDEO  ;HL==> TOP OF SCREEN
BBBF C9         02590      RET                      ;AND RETURN
                   02600 ;
BBB0 3A4038     02610      GETENT   LD      A,(ROW7) ;GET ENTER ROW
BBB3 E601       02620      AND      01H      ;CHECK FOR <ENTER>
BBB5 28F9       02630      JR      Z,GETENT  ;LOOP UNTIL FOUND
BBB7 3AFF3B     02640      GET10   LD      A,(3BFFH) ;CHECK FOR NO KEYS
BBBA B7         02650      OR      A        ;SET FLAGS
BBBC 20FA       02660      JR      NZ,GET10  ;LOOP UNTIL NO KEY
BBBD C9         02670      RET                      ;THEN RETURN
                   02680 ;
                   02690 ;
BBCE 02700      02700      ASCPRT   EQU      $      ;PRINT HL VAL ON SCREEN
BBCE EB         02710      EX      DE,HL     ;SAVE HL REG.
BBCF CD92BB     02720      CALL     PUSHAL   ;SAVE REGS.
BBD2 EB         02730      EX      DE,HL     ;RECOVER ORIG HL VALUE
BBD3 CD9A0A     02740      CALL     HLACUM    ;HL==> ACCUMULATOR
BBD6 CDC00A     02750      CALL     ACINSN    ;ACCU INT=> SINGLE PREC.
BBD9 CDBD0F     02760      CALL     ACUSTR    ;MAKE ACCUM INTO STRING
BBDc 23         02770      INC      HL      ;SKIP LEADING SPACE
BBDd CD752B     02780      CALL     PRINT    ;PRINT VALUE
BBE0 CD9BBB     02790      CALL     POPAL    ;RESTORE REGS.
BBE3 C9         02800      RET
                   02810 ;
                   02820 ;
                   02830 ; Now table, message, & buffers
                   02840 ;
BBE4 50         02850      MSG      DEFM    'Press <ENTER> ....'
                   72 65 73 73 20 3C 45 4E
                   54 45 52 3E 20 2E 2E 2E
                   2E
BBF6 00         02860      DEFB     00H      ;END OF MSG MARKER
                   02870 ;
BBF7 25         02880      TYPES   DEFB     '% '      ;LIST OF VARIABLE TYPE
BBF8 24         02890      DEFB     '$ '      ; MARKERS
BBF9 21         02900      DEFB     '! '
BBFA 0000       02910      DEFW     00H      ;PAD WITH 3 SPACES
BBFC 00         02920      DEFB     00H
BBFD 23         02930      DEFB     ' '
                   02940 ;
0400           02950      SCRBUF   DEFS     400H    ;BUFFER FOR SCREEN
                   02960 ;
0002           02970      CRSBUF   DEFS     2H      ;BUFFER FOR CURSOR POSN
                   02980 ;
BA52           02990      END      SETUP    ;END OF PROGRAM
00000 TOTAL ERRORS

```

ROM print routines; the disadvantage is that the information for some variables might be broken between two different screen lines.

The first part of the array sequence is similar to the logic in the simple-variable routine: The name and type of variables are displayed. But starting

with line 1770, the program includes some new logic to display the maximum value of each element of the array.

The C register holds the number of dimensions (1-255). Then the offset value plus five is added to the current value in IX to determine the starting address of the next array in the table. The program stores this new address on the stack.

By adjusting the IX register, the computer loads each dimension size into the HL register and prints it on the screen, followed by a comma. Because the program stores the dimension indicators in reverse order, the routine has to go through some contortions to keep the IX register correctly aligned. Finally, the program checks the current print position on the screen and then the routine loops back to display another array variable.

The last program section, Done, restores the original screen and the original cursor position. All original registers are popped off the stack and control returns to the regular keyboard scan routine and Basic. The Basic program continues functioning as if it were never interrupted.

The program's subroutines show some interesting programming techniques. PUSHAL and POPAL push or pop all registers at once. They cut down the length of the overall program.

The problem with using subroutines to push all registers is that you can bury the normal return address in the stack beneath the register values and the program won't know where to go after the return instruction. PUSHAL avoids this problem by first exchanging the return address for the value in HL, then saving all other registers, and finally putting the return address back on the stack.

The trade-off is that this subroutine changes the value in HL. If you want to save all registers but leave HL unchanged, the calling routine must save the HL value in another register, call PUSHAL, and then reclaim the HL value from that other register. The beginning of the ASCPRT routine shows how to do this.

ENDSCR saves the registers, moves the cursor position to the last line, and prints a message. Then it checks to see if you pressed the enter key, clears the screen, points HL to the top of the screen, and returns. Notice that the message is displayed by using the ROM

Print routine at 2B75 hex.

GETENT is a simple subroutine that waits until you press and release the enter key to continue. It is important for the computer to check for the key release; otherwise, the program may go charging ahead before you have time to let go of the key. GETENT reads the keyboard directly; it doesn't use a ROM routine to read the keyboard because of a possibility that you might again press the shift, down-arrow, and V keys and cause the entire program to loop back on itself recursively.

*"PUSHAL and POPAL
push or pop
all registers at once.
They cut down the length
of the overall program."*

The most interesting subroutine is ASCPRT, which takes the value in HL and displays it on the screen in unsigned integer format. It does so by using three crucial, though little-known, ROM routines: HLACUM (0A9A hex), ACISIN (0ACC hex), and ACUSTR (0FBD hex).

Basic maintains a buffer inside low memory called an accumulator that it uses every time it manipulates a data value. ROM routine HLACUM (0A9A hex) loads the current contents of HL into that accumulator and sets a flag to indicate that it's an integer value.

Next, ACISIN (0ACC hex) changes the integer value into single-precision form. It is the routine Basic uses for the CSNG function. However, when used this way, ACISIN treats the value in the accumulator as an unsigned integer (between 0-65535) instead of the more normal signed integer value (-32768-32767).

Finally, ACUSTR (0FBD hex) takes the current value in the accumulator and turns it into an ASCII string so the number can be displayed on the screen. The program puts the string in another low-memory buffer at 4130 hex. Then the program returns the address of the beginning of the string in HL. Normal display format includes a leading space, which can be avoided by incrementing HL once before printing the string. Notice that ASCPRT uses the Print routine to display the number; an

- ☒ ADD
- ☒ CHANGE
- ☒ DELETE
- ☒ SORT
- ☒ SELECT
- ☒ SAVE
- ☒ PRINT
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- ☒ REPORT
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THE NEXT STEP

ASCII string is an ASCII string—
whether it contains letters or numerals,
you can use the same display tech-
niques.

The three ROM calls used in
ASCPRT make up a very powerful,
simple method for displaying any 1- or
2-byte binary value in ASCII. Together,
they are much slower than a traditional
routine that subtracts successive powers
of 10 to translate binary to ASCII, but
they operate fast enough to satisfy most
uses and only require 9 bytes of pro-
gram space to perform the conversion.

To use the variables display program,
enter it from DOS READY or with
SYSTEM after you have assembled it.
You can then observe the currently de-
fined variables at any time a Basic pro-
gram runs or after it completes running
and returns to the READY prompt.
This program does not search your
Basic program to look for the variables;
instead, it uses the tables in memory to
determine which variables are defined.
The variables aren't displayed until
your program starts to run.

Next month I'll add the capability to
display the current values of each vari-
able by using other ROM routines, and
I'll discuss ways to speed up your Basic
programs by using the information
shown in the variables displays.

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This month I have two innovative utility programs, Larry Preble's VDOS and Hal Snyder's MDISK. Both are virtual disk programs that let you store other programs and data in RAM for high-speed recall at a later time. Both address the question of how a cassette-based Color Computer can use a 64K memory expansion.

Floppy disks have a couple of well-known advantages as information storage media: They are relatively fast, and they permit random access. Since moving parts are involved, the access and transfer of information is always far slower than the operating speeds of computers linked to disk drives.

Computer users are never satisfied with a system's speed, so it was probably inevitable that people would hit on the idea of using blocks of RAM to simulate disk operations.

In principal, you can store information in RAM using a disk format. You can have a solid state analog of the directory track, file headers formatted just as they are on disk, and storage assigned in discrete grants, sectors, or whatever the computer's normal disk operating system uses.

Of course, the data is volatile, disappearing when you turn off the power, but you can handle that by backing up the virtual disk to a real disk or to tape whenever appropriate.

This idea has been around for a while now. A number of add-on memory boards, capable of emulating very fast disk drives, are available for computer systems that use the S-100 bus.

Color Computers are somewhat limited in the amount of memory they can address. Nevertheless, you can apply the concepts of RAM disk emulators, or virtual disks.

That's where VDOS and MDISK come in. For a modest price, they give the CoCo user the ability to load several files into RAM and forget about them until he needs them.

The files can be Basic or machine-language programs, or data files. You can access them in any order, and transfers to and from active memory are usually fast enough to be considered instantaneous from the user's point of

Virtual disk systems and connectors

view. Neither utility is all powerful, but both deserve a look.

VDOS and VDUMP

As I write this, VDOS 1.0 is only available on cassette (Dr. Preble's Programs, 6540 Outer Loop, Louisville, KY 40228, \$49.95). Its primary intent is to give cassette users a taste of the speed of disk operation.

Its name stands for Virtual Disk Operating System, indicative of the vendor's intention to support it with enough utilities to make it into a real system. Meanwhile, a disk version is also in the works to serve as an additional high-speed "drive" for disk users.

Although you could set aside any part of RAM for use as a virtual disk, the best idea is to use the upper 32K of a 64K machine. This is the so-called Page 1, the area not normally accessible to the Radio Shack operating system because of address conflicts with the Basic ROMs. It represents the largest single block of space the CoCo can free up.

In any case, VDOS itself determines the size of the memory in its host machine, and locates itself near the halfway point. All the memory above VDOS is available for file storage, while you can use everything below in the conventional fashion.

In a 64K cassette system, the default partitioning is 24,733 bytes for programming, and 30,407 bytes for VDOS's files (assuming four graphics pages and 200 bytes of string storage). If necessary, you can expand the VDOS area to around 54K at the expense of user RAM.

Once you load the program, you invoke it with the VDOS command—a new Basic command, in effect. A simple menu appears: You can view the VDOS file directory, save a Basic or machine-language program from user RAM to virtual disk, load a program back the other way, kill a VDOS file, or exit to Basic.

The routine for loading a series of Basic programs into the virtual disk area is to return to Basic from VDOS, load the first program, and invoke VDOS. Then select the Save a Basic Program option. Once you've saved the file, go back and repeat this whole sequence as often as necessary. The first and fourth steps require only single-digit commands.

You can save machine-language programs in much the same way, except for a couple of potential complications. Many machine-language utilities are supposed to load into high RAM; you must be certain that they don't overlay the area used by VDOS itself.

VDOS helps by informing you as to the top of available memory when you first load it. This is address 32,642 in a 64K system. You can use the default start, end, and transfer addresses recorded along with machine-language routines on tape, or specify your own.

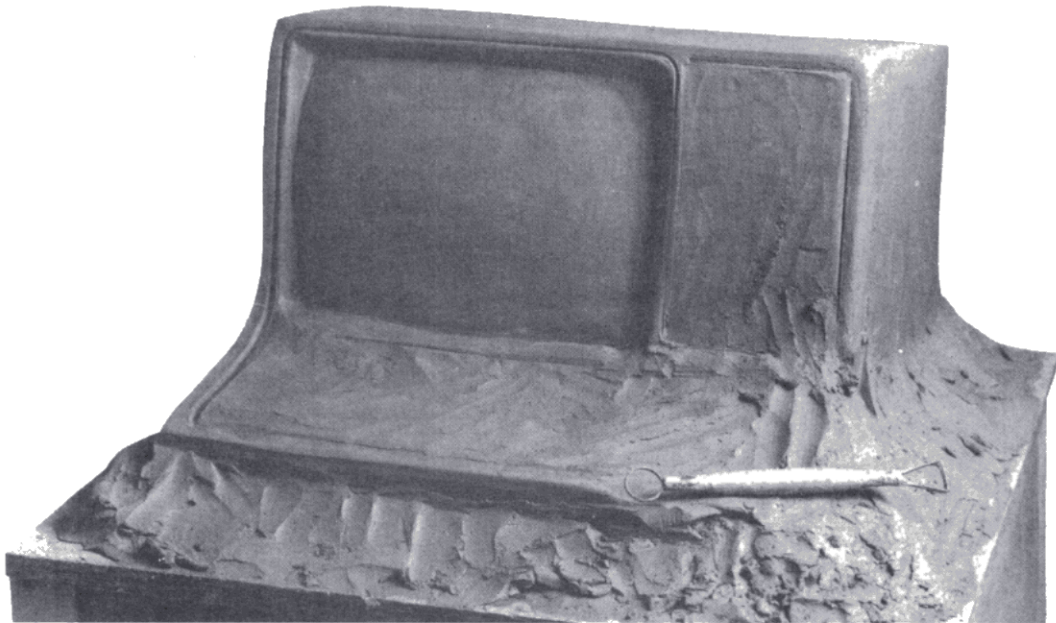
Even if a machine-language program seems to fit in the space below VDOS, be cautious. Some routines need stack space that interferes with VDOS's pointers, located just above user RAM. I ran into this situation with my relocated version of Master Control, as I'll describe later.

Once you actually get a collection of programs into VDOS, it's a simple matter to pull them out into Page zero (the user-accessible part of RAM) and run them. You merely get into VDOS, choose the Load a Basic Program or Load a Binary File option, and specify a file name.

Then exit to Basic (even for machine-language programs) and Run or EXEC as appropriate. When you're through with one program, end it and return to VDOS to select another.

In general, it's unnecessary to clear Page zero between programs. I feel uncomfortable using VDOS with pro-

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grams that disable the break key, since at best that leaves only the reset button to return control of the computer to me for further work. Although VDOS seems to survive a reset, I prefer less drastic methods for regaining control—especially since reset doesn't work with some routines.

Programs with automatic loaders that seize control of the computer aren't good candidates for use with VDOS. It might be possible to load such beasts with offsets so they don't take over, and then get them into the VDOS area, but this can be touchy.

I've found VDOS to be most useful when loaded with a few of the more tractable utilities or games. However, that might reflect the complacency of someone who already has a couple of floppy drives and uses programs that require all 64K of RAM.

If you have a favorite bunch of routines to use with VDOS, you probably won't want to load them one at a time very often—say more than once. A VDOS utility called VDUMP takes care of that.

It lets you dump everything in your virtual disk onto a single tape file, and reload the same way. Dr. Preble sells VDUMP for \$14.95.

You load VDUMP after everything is in the VDOS area. It has only two options: Dump and Load. To store your virtual disk, cue up a blank tape and press the D key. The tape records only the portion of RAM actually used for VDOS files.

When you want to reload for a new session, load VDOS, load and execute VDUMP, put the file tape in the recorder, and hit the L key. VDUMP destroys itself afterwards and returns you to the Basic command mode so you can enter VDOS.

A hitch to all of this came up during my experiments with Master Control. That utility was written for a 16K machine, with start and finish addresses of 15104 and 16380. Standard practice with 32K of available RAM is to load Master Control with a 16,000-byte offset, putting it between 31104 and 32380.

Those were the addresses I specified when I loaded it into VDOS, and everything seemed OK. Master Control worked, and the VDOS directory listed the offset addresses as it should. In particular, no conflict appeared with VDOS's lower limit of 32643.

A problem developed with VDUMP,

though. When I tried to dump the VDOS area to tape, the recorder never stopped. Larry Preble suggested that interference was affecting some of the VDOS pointers (like the one that defines the top of the virtual disk).

He was probably right. Everything

*"The general idea
of virtual disk storage
is a good one,
and it might make life
quite a bit easier..."*

worked well when I later loaded Master Control with 8K of offset to leave plenty of room at the top.

The moral here is that you might have to experiment a little with your favorite programs to see what works. The general idea of virtual disk storage is a good one, and it might make life quite a bit easier for cassette system users.

MDISK

MDISK 1.1 (Skyline Marketing Corp., 4510 W. Irving Park Road, Chicago, IL 60641) provides an interesting contrast with VDOS. VDOS works with any memory size from 16K up, but MDISK is intended for use with 64K Color Computers alone. It only stores 15 files, too, while VDOS apparently handles as many as fit into available memory.

On the other hand, you can readily interface MDISK to Basic so one program can call another from the virtual disk area. It automatically executes programs called up in this way, too, although this function has a small bug.

MDISK also features a built-in RAM test routine to ensure that Page 1 is functional. The program is available on tape for \$27.95, and on disk for \$29.95.

The disk version of MDISK consists of a single two-granule file. Before loading it, you must reserve space at the top of the Page zero RAM with a CLEAR 200, &H77FF command; the program issues a warning if you've set aside insufficient space.

Despite their great differences, MDISK and VDOS actually work similarly. Both have a single command menu plus a file directory display, and both have commands for saving, re-

loading, and killing Basic or machine-language files.

MDISK's default storage area is somewhat the larger of the two: just over 32.5K at startup. A couple of prompts on the main menu inform the user of the number of files stored and the remaining virtual disk space.

MDISK commands consist of a single letter, sometimes followed by user responses to screen prompts: D brings up the directory of stored files, E exits to Basic command mode, S saves a file from Page 0 to Page 1, and so on.

The cycle for loading the virtual disk area is similar to that of VDOS, except the method of reentering the utility itself. MDISK requires an EXEC command; if you've loaded a machine-language program into Page zero in preparation for storage, you must use EXEC &H7800 to ensure that you execute MDISK rather than the other program.

Since you have only one command to save a file and one to reload it into user RAM, MDISK queries you about the nature—Basic or machine-language—of any program you want saved or loaded. If you work with a machine-language file, you have to specify the start, finish, and transfer addresses as four-digit hexadecimal (hex) numbers.

After stuffing a half-dozen or so utilities into Page 1, I noticed a significant deficiency in MDISK: It doesn't have a way to save the virtual storage area to tape or disk. That's a flaw in VDOS too, but Preble's program has VDUMP to help out.

I hope that MDISK author Hal Snyder or someone else will remedy the situation in a hurry. A dump-to-magnetic-medium routine should be an integral part of any virtual disk package.

To invoke a saved program from MDISK's manual mode, you must download it to Page zero with the L(oad) command and then issue a R(un Basic) or a G(o to machine language).

An alternative is to call MDISK and perform the download from within a Basic program. The key is to use another MDISK entry point, &H7803. This suppresses the usual menus and prompts, and lets the program accept commands from a Basic string.

Load MDISK in the usual way, storing whatever you want in the virtual disk buffer. Then load and run the Basic program that will eventually call something from storage.

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TELEMARKET DEPT. 4

This program should define the entry point with DEFUSR0=&H7803, and should execute the call with X\$=USR0 ("..."). The argument of that USR function is a string that mimics the MDISK commands you'd normally issue in manual mode.

To check this out, I loaded MDISK's storage area with a game called Joust. I then typed the calling program into Page zero:

```
10 DEFUSR0=&H7803
20 CLS: PRINT "PRESS ANY KEY TO PLAY."
30 IS=INKEY$: IF IS="" THEN 30
40 X$=USR0("L JOUST. B R")
```

The entries between quotation marks in the USR argument are, respectively, the Load a Program to Page zero command, the program's name (the period is an optional MDISK delimiter), the Basic identifier, and the MDISK command to run any Basic program in Page zero.

Pressing any key should have replaced my little program's message with the opening of Joust. It didn't work that way. Instead of the game, I got MDISK's menu, a signal that I had reached the end of my command string while MDISK was still executing—downloading the Joust file. I had to hit the R key again to run the game.

"OK," I thought, "Joust is a 4-gran file, and maybe it takes a little too long to transfer something that size. I'll try it with a smaller routine in virtual disk."

No luck. I couldn't get automatic downloading and execution for any file down to a few dozen bytes in length. Terry Haas at Skyline Marketing assured me that this feature worked perfectly in earlier versions of MDISK intended for smaller-RAM Color Computers.

It turns out that the INKEY\$ function messed up the timing. Automatic downloading and execution worked perfectly well when I did away with keyboard scanning, like this:

```
10 DEFUSR0=&H7803
20 CLS
30 PRINT "HERE WE GO..."
40 FOR T=1 TO 500: NEXT
50 X$=USR0("L JOUST. B R")
```

Actually, the sample program in the MDISK documentation uses this sort of syntax. People writing their own applications programs ought to be aware of the bug, though. Keyboard scanning

routines should probably branch to a short timing loop to get things into sync for a file transfer.

It's also possible to have a Basic program reserve memory, load MDISK, and upload a file to Page 1. The instruction leaflet shows how to do this for a machine-language utility, and I found I could upload the calling program itself:

```
10 CLEAR 200, &H77FF
20 LOADM "MDISK"
30 DEFUSR0=&H7803
40 X$=USR0("S TESTPRO. B E")
50 CLS
60 PRINT "I JUST UPLOADED MYSELF!"
70 GOTO 70
```

The final E command that normally causes an exit to Basic also returns control to the calling program when you're in the automatic mode. I don't have any idea why you'd want to have such a program save itself to the virtual disk area. This exercise shows that MDISK can indeed store Basic routines in this way.

Both VDOS and MDISK are rather interesting programs, especially for those who intend to stay with cassette storage. My feeling is that some sort of cross-bred virtual disk would be even better: a VDOS with automatic execution capability, perhaps, or an MDISK with VDUMP on the side.

Going for the Gold

In the June edition of *The Color Key* (p. 32), I mentioned that I was looking for gold-plated connectors for my Color Computer's disk controller. Oxidation of the base metal contacts on the controller's printed circuit board is a major cause of CoCo disk drive malfunctions; mine usually act up after I've finished polishing a long piece of text.

Out of the west rides the U.S. Cavalry in the person of Ed Pruett of the E.A.P. Company (P.O. Box 14, Keller, TX 76248). Ed manufactures the Gold Plug 80 series of add-on connectors that solve many a Model I problem, and his new product line should be a hit with any CoCo disk operator capable of a little soldering.

Items in the E.A.P. lineup include 34- and 40-pin male fittings for either end of the disk controller and for the drives themselves, female connectors for the CoCo's main circuit board, and two-drive and four-drive cables with gold-plated connectors of their own.

Since the controller to computer connection is the weak link in my system, I opted for installing only the 40-pin adapter on my controller board.

It's not an especially difficult job, but it's a bit tedious. You remove the disk controller from its case, insert the card-edge connector into the open tabs on the rear of the Gold Plug, align one circuit trace to a tab, and solder away.

The tricks are avoiding solder bridges between tabs and applying enough heat to do the job without lifting the traces from the printed circuit board. If you've never worked with a fine-tip soldering iron and a PC board, you might practice on something like a Radio Shack Experimenter's Board before attacking your computer.

One additional complication is associated with the 40-pin connector. As the instruction sheet explains, four grounding tabs are on the controller board: one on either surface of the board and on either end of the connector.

These make contact with ground connections inside the computer's cartridge slot. E.A.P. furnishes four separate extensions (base metal—not gold) that you have to solder to these tabs, if you are to keep radio frequency interference to a minimum.

This can be tricky, since you have to align the extensions with both the PC board connections and the Gold Plug itself; the extensions must protrude no more than 1/2 inch from the board's edge if everything is to make contact when you reconnect the disk controller to the computer.

It's not an impossible task, though, and the increased reliability of my system makes it all worthwhile. I don't get those maddening I/O ERROR indications any more.

Gold Plugs are available individually or in combination packages, at prices from \$9.95 to \$19.95. Get in touch with E.A.P. for the details.

Incidentally, E.A.P. has a very civilized policy: If you buy connectors then get cold feet when the soldering job confronts you, you can return the undamaged hardware for a refund. I guess Ed understands that some computer users didn't come up through the ham radio ranks. ■

Scott Norman welcomes reader response to The Color Key. Write c/o 80 Micro, 80 Pine St., Peterborough, NH 03458.

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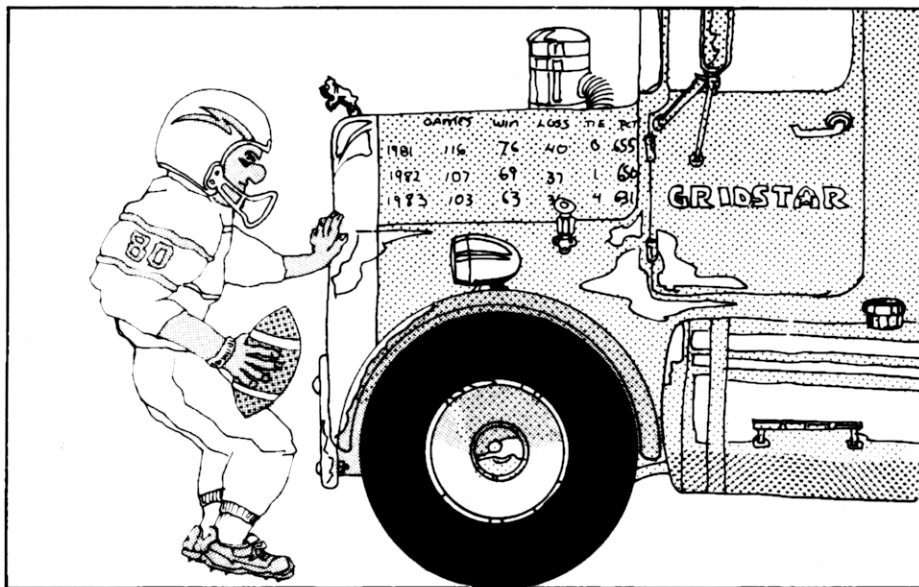
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★★★★

Gridstar
GridSoft Inc.
7777 Keele St., Unit 8
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Canada
Models I and III
48K, one disk drive
\$195

by Avery Jenkins

Cleats thudding on turf. Linemen's grunts as they force open a hole. The thrill of victory...the agony of defeat.

Sportswriters would have you believe that those are the reasons football is America's fall passion. Actually, the attraction is much more elemental: money. Football is a gamble on which any sentient human can at least break even.

It is for the weekend warriors of the bookmaker's line that GridSoft introduced Gridstar—a convenient, fairly accurate, and versatile football data base and betting analysis program.

The data base contains the outcomes of a 10-year span of games, from 1973 to 1983. Information stored on the data base includes home and away team designations, the score, and the betting line for each game. The date and the day and week in the season are also included in the 16-byte record for each game.

Each logical record contains information for 16 games, and is accessible either by record number or by a week/year specification. A two-letter abbreviation specifies teams: AT for the Atlan-

ta Falcons or NE for the New England Patriots.

Included in the package is a data-base manager that lets you update, scan, or search through the data. The search function is unusually complete—it lets you specify 20 search parameters and displays all games that meet your criteria.

That's a lot of information to have on hand if you're used to basing your strategy on what you can remember of last year's season and naked intuition. To get the feel of what's in the data base, I began by scanning it 10 games at a time. The games flash by quickly unless you stop the display by hitting any key. Don't expect it to be easy to read until you know the format.

To add records, specify the last record number plus one for the edit mode, and add the new information. After completing your update, you have to manually call for an index update. The system is a trifle crude, but it gets the job done.

Putting It Together

Trying to make all this information coherent is a little like balancing your checkbook for the first time in 10 years. Unless you're looking for data on a specific game (never a bad route to a free beer or two) or refreshing your memory, the data base is useless without some analysis. Programs that do this form the second part of Gridstar.

Using a limited amount of information for each game, Gridstar's developers came up with a multifaceted betting strategy. They include all the angles that performed better than 60 percent over

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Our reviewers use a five-star rating system. One star represents the low end of this spectrum, while five stars represent the spectacular and high end of the spectrum.

10 years with no low seasons, and that had some sort of logical backing.

The simplest of these is the point spread analysis. Granted, the results are often a matter of common sense—large home underdogs are frequently a good play, as are home-team bets on an even game.

But the analysis points out that the half-point can make a difference, something I haven't previously counted on. The only season where this strategy produced less than a 60 percent success was 1982, and that's a forgivable error.

The second analysis is a study in Monday Night Football. Again, this technique relies on some common sense: The home team is a good bet on Mondays, given the special event feeling these games have.

However, the Gridstar system doesn't include the "week-after" syndrome, a long-time favorite. Statistically, GridSoft says, the theory that teams perform poorly the week after a Monday night game is not born out. Caveat bettor.

Perhaps the strongest approach Grid-

star uses is a power rating system that you can then use to create a line more accurate than the betting line. Power rating is based on previous performance, and is a recursive function taking into account the opponent's changing power rating.

Unfortunately, the system doesn't come into its own until late in the season. Also, unlike the betting line, it doesn't take injuries into account. Your compensation appears in a linear regression that the program performs on the 10 years of information in the data base, which it also incorporates into the results.

Time Out

All this analysis takes a long time—about an hour—but is a sight better than trying to work it out in your head. A quicker approach is the head-to-head analysis, which relies on only the previous three years of games between any two teams.

The program calculates a short-form power rating from this information, weighted according to the game location and the previous number of games played.

The combination of these methods makes the Gridstar analysis a fairly potent system. Like all systems, it has pitfalls resulting from season events—injuries, weather, and so on—that it can't take into account. And although the manual doesn't mention it, the database search procedure provides a good way to get information for a manual or more intuitive analysis.

One way might be to write your own analysis program that uses the data base. The documentation provides all the technical details you'd need to interface your own program with the data. Then, by testing the results for success over the 10-year span, you could refine both your personal techniques and your use of the Gridstar system analysis.

I wouldn't rely solely on Gridstar to determine my betting strategy for me. The system does allow for season budgeting, most useful if Gridstar plays a large part in your strategy. Without it, you'd send up a lot of trial balloons before finding a profitable level.

But if you combine this software with some sound judgment and you're willing to go against the calculations for deviant circumstances, you could make next season pretty profitable. ■

★★★★

Pocket Computer Model PC-4
Tandy/Radio Shack
One Tandy Center
Fort Worth, TX 76102
\$69.95

by David Goodwin

The Radio Shack PC-4 is an ultra-compact, expandable computer that's perfect for someone who wants computer power to go. It's less expensive and more powerful than a programmable calculator and it supports Basic, not some unique mnemonic language.

The PC-4 has 544 program steps and 26 variable memories (see Table 1). You can expand the memory to 1,568 steps with the optional 1K memory pack.

You can partition the program steps into variable memories at the ratio of 8-to-1, and set up your own memory space. Powered with a two-year battery for long life, the PC-4 retains all programs and variables when you turn it off.

An optional battery-powered cassette tape interface is available for \$39.95, as well as a printer attachment for program listings (\$79.95).

The PC-4 uses a 12-character liquid crystal display (LCD) that acts as a window on a line that can be up to 62 characters long. The full set of keys is closely spaced and unsuitable for touch typing—not a serious problem on this type

of machine.

The keyboard supports both upper- and lowercase letters, and single-key entry of common Basic keywords. The PC-4 also has a set of graphics and special characters.

The PC-4 uses a derivative subset of standard Basic. The list of commands (see Table 2) is quite complete.

The only complaint I have is the inclusion of the CSR option in Print statements. The ROM space this command occupies could provide more common commands such as ASC, STR, and so on. I haven't found any use for a display positioning command on a 12-character display.

Another small handicap is that the length of string variables is limited to seven characters. The special string variable \$ stores one string of up to 30 characters. I think two special string variables would have been a better idea.

PC-4 Basic has all the usual functions of Basic and some that are more common to a scientific calculator. Table 3 lists the available functions. It has floating point arithmetic with 12-digit precision.

The PC-4 supports array variables, although not in the usual manner. Arrays use up memories in order, so that A(1) is memory A, A(2) is memory B, and so on. The PC-4 supports only single-dimension arrays.

PC-4 Basic isn't elegant, but it gets the job done anywhere you might happen to be.

Keyboard:	Chiclet type, 53-key, multi-function, single stroke keyword entry.
Display:	One line, 12-character LCD with horizontal scrolling and predefined graphics.
Memory:	544 steps, optionally expandable to 1,568 steps maximum. 26 variables standard, expandable to 94 or 222 with expanded memory.
Precision:	10 digit mantissa, or eight digit mantissa with two digit exponent, on display. 12 digit internal calculation.
Nesting:	Eight levels of subroutines. Four levels of For...Next loops.
Power:	Two Lithium batteries, approximately 360 hours of continuous use.
Size:	3/8 inch high by 6 1/2 inches wide by 2 3/4 inches deep. 4.1 ounces with batteries.
Expansion:	Optional 1K RAM module. Optional cassette interface. Optional thermal printer.

Table 1. PC-4 specifications.

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Keyboard:	Chiclet type, 53-key, multi-function, single stroke keyword entry.
Display:	One line, 12-character LCD with horizontal scrolling and predefined graphics.
Memory:	544 steps, optionally expandable to 1,568 steps maximum. 26 variables standard, expandable to 94 or 222 with expanded memory.
Precision:	10 digit mantissa, or eight digit mantissa with two digit exponent, on display. 12 digit internal calculation.
Nesting:	Eight levels of subroutines. Four levels of For...Next loops.
Power:	Two Lithium batteries, approximately 360 hours of continuous use.
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Table 1. PC-4 specifications.

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REVIEWS

charger. You can't charge while the printer is connected to the PC-4.

The printer drains the computer's battery if it's left connected for an extended period. It must use the power from the PC-4 to determine that the computer is connected, since it won't print if it's unconnected, or if the computer is off.

A paper feed key manually advances the paper. The printer uses paper made by Casio for their CP-10 Card Printer calculator.

You can use the printer for listings or calculation results. Switch it on and off with the PC-4 mode key. Mode 7 is Print On; Mode 8 is Print Off. You can also use these mode changes within programs for selective print control while a program executes. You can print all the PC-4 characters.

The only problem I have with the printer is that it sometimes doesn't make a good connection with the ex-

pansion port, and the system returns an Error 9—No Printer Connected message. A small adjustment of the printer connector usually solves this problem. ■

SIN	Sine
ASN	Arcsine
COS	Cosine
ACS	Arcosine
TAN	Tangent
LOG	Logarithm
LN	Natural Log
EXP	Exponential
SQR	Square Root
SGN	Sign
RAN#	Random Number Generator
RND	Rounding
ABS	Absolute Value
INT	Integer
FRAC	Remainder

Table 3. PC-4 Intrinsic Basic functions.

★ ★ ★ ★

Softcomm Smart Terminal

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by Mel Patrick

Softcomm 3.0 is a smart terminal program that adds communications capabilities to your computer system. Smart terminal programs allow options like saving and loading files for uploading and downloading, changing RS-232 parameters, and programming buffers for auto log-on or simple text transmission.

As with all smart terminal programs, Softcomm has a command mode and a communications mode. The command mode selects one of many optional functions, such as loading a file in preparation for transfer to another system.

You enter the command mode by pressing the clear key. You return to the communications mode when you hit the break key or when the program completes the option you've selected. Table 4 provides an overview of the available commands.

Using Softcomm

Any software with complex options available has room for improvement, and Softcomm is no exception. A situation I found particularly annoying is when you have information stored in the main buffer that you want to review.

At present, Softcomm won't let you view the contents of the main buffer. To get around this problem, I save the buffer to disk and, since Softcomm supports DOS commands, I use List to see the file.

Softcomm also has many advantages. One is its ability to transfer binary (/CMD) files without additional utility programs for file conversion between two systems (as long as both use Softcomm).

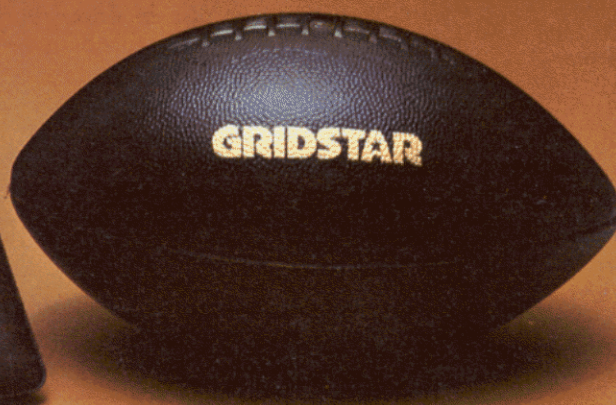
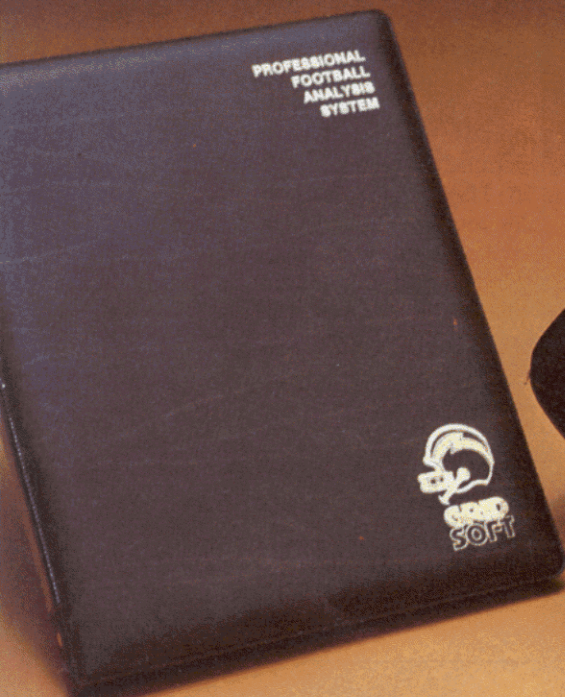
Also, you can use the programmable buffers as a phone number directory (since you can save them, it's possible to have multiple directories), and dial the Hayes Smart Modem or the Radio Shack Modem II.

You can also use the buffers to simplify leaving a message on a remote bulletin board system. The buffers allow 255 characters (with carriage returns where necessary) and most bulletin boards use the message format of 16 lines with 64 characters per line.

It's a simple task to program the mes-

Continued on p. 54

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	Games	Win	Loss	Tie	Pct
1973	116	76	40	0	.655
1974	107	69	37	1	.650
1975	103	63	36	4	.631
1976	126	71	51	4	.580
1977	130	77	43	10	.631
1978	128	75	46	7	.613
1979	149	94	51	4	.644
1980	131	90	37	4	.702
1981	148	93	52	3	.639
1982	57	34	23	0	.596
TOTAL	1195	742	416	37	.636

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WOBOS I for Model III BASIC		00	01	02	12	34	56
PROGRAM MENU		UTILITIES					
1	Your Program A	11	Data List				
2	B	22	Sort				
3	C	33	Renumber				
4	D	44	Append				
5	E	55	Memory Dump				
6	Graphics Synthesis	66	Map				
7	Special characters 0-31	77	Size				
8	91-127	88	New Data Entry				
9	192-255	99	Device I/O				

Illustrated above is the Primary Menu of WOBOS I for Model III. In addition to the features shown, the DEVICE I/O generates a separate 9-choice menu that will allow you to compile, update, sort and output your data files. It also includes a utility that will save both the DATA and WOBOS I on tape and/or disk.

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REVIEWS

Games at a Glance

Arex, Adventure International, A Division of Scott Adams Inc., P.O. Box 3435, Longwood, FL 32750, Models I and III, 48K, \$34.95 disk.

by Amy Campbell

Arex requires that you develop a unique combination of skills. At times it teases you to be hasty, but patience and cautious planning are the keys to success.

You play the game on a square grid. By moving your Arex ship in horizontal and vertical directions, you leave a white trail that fills the screen. When you fill 90 percent of the board, you advance to the next level.

It's a simple premise, but the game's unpredictable special features keep it from becoming monotonous.

For instance, at the start of each level, various good guys (Snarfs) appear. As you fill the screen, intercepting these characters increases your point value.

If Snarfs elude you too long, they turn into one of two bad guys: Snufflers move in right angles across the screen, and Diagonals move diagonally. Both are deadly. To overcome them, you must box them in by surrounding them with your impenetrable trail or avoid them long enough to complete the screen and move on to the next level.

If you remain still for too long, the trail left by your ship begins to burn like a fuse and can destroy you from behind. The burnt portion of your trail is deadly, but a Snarf can eat away at it, freeing more space to maneuver the Arex. This feature sometimes gets you out of a real jam.

There's one more feature with which you must contend. When Snarfs appear on the screen and interact with another character, they can metamorphose. Sometimes both characters turn good; other times they both turn bad. This adds an interesting twist.

Once you understand the basics, Arex becomes a game of filling space and capturing enemies in the most efficient manner. The key to efficiency isn't necessarily speed or caution or luck or strategy: It's all of these. ■

Emperor, Computer Shack, 1691 Eason, Pontiac, MI 48054, Models I and III, \$19.95 cassette, \$24.95 disk.

by Thomas L. Quindry

Emperor is a Basic game of strategy that taxes your ability to wage war against enemy barbarians. You are the Emperor. Your objective is to campaign for more territory, protect the Roman Empire from the barbarians, and keep its populace from revolting.

The Empire appears semigraphically on the screen at all times. Under each province is a list of data indicating its number of loyal Roman legions, revolting legions, and invading barbarians.

You must decide where to put your loyal legions, keep them loyal by providing food and entertainment, watch your generals, and protect your grain source (which grows in a province highly subject to enemy intrusion). You raise money through taxation, a predictable cause for revolt.

Raising legions and moving them to crucial provinces is no simple task. You raise all legions in Italia, the center of the Roman Empire. You must move them through adjacent provinces to their destination.

You can move as many legions as you wish during each turn, but you have only one move per legion. On the other hand, you can dispatch generals anywhere at a moment's notice.

Armies of four or more legions must have a general. Otherwise, a general is optional. Your generals all have ratings for fighting ability and loyalty, so each one might be a hindrance or a help during battle.

The loyalty rating should influence the power you give each general. If you give the disloyal ones too many legions, they might revolt. If you campaign with them, you can prevent them from revolting.

This game is a sleeper. It doesn't seem very interesting at first exposure, but if you take the time to learn how to play, it can be rewarding.

It's not too user-friendly. At times you might need to take handwritten notes of the actions you've taken in order to keep track. ■

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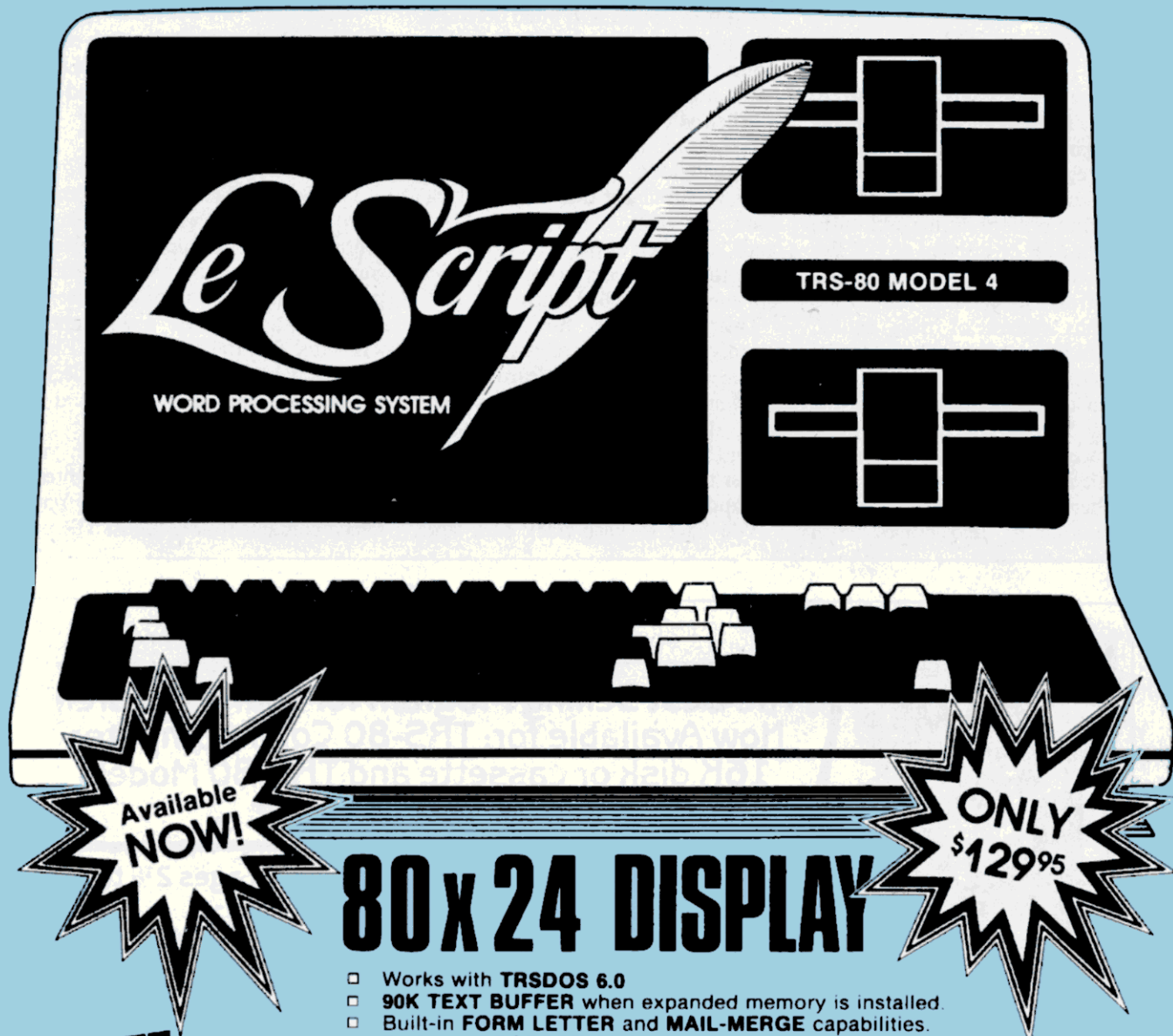
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Games at a Glance

Crusaders, Computer Shack, 1691 Eason, Pontiac, MI 48054, Models I and III, \$19.95 cassette, \$24.95 disk.

by Thomas L. Quindry

Crusaders tests your ability to defend your fortresses against an enemy who is trying to put them under siege. This strategy game is written in Basic.

As the crusader, you can take any or all of four options during each turn. You might raise or disband any of five available caravans that transport food from fortress to fortress.

Caravans consist of pack mules, camels, and horses that carry specified amounts of food. Certain costs are involved in raising and maintaining the caravans. You obtain money by the good graces of European aid arriving at specific intervals.

Another option is to move troops. Knights, infantry, and horses travel

along specified routes depending on their current location. If you try to move to a besieged fortress, you must battle the enemy.

You can also buy food for caravans, knights, infantry, and horses. The fourth option is to build defenses. You gain defense points by spending money, so you must ration your available funds between the four options.

When you decide to end your turn, the program computes resulting actions based on your decisions. Two maps are available that indicate locations of various fortresses. These maps are also displayed during options to list crusader controlled lands and enemy controlled lands.

This program is not very user-friendly. You need an appendix, given in the instructions, to learn certain beginning information about each fortress. If you move troops or change defenses, you must have a good memory or take notes. This information is not updated for display.

You have to keep track of a large

number of fortresses. Information about actions at these fortresses scrolls by and is hard to remember.

In my opinion the game is too busy. It's long and events occur slowly. ■

The Search for Elsoliado, Adventure International, P.O. Box 3435, Longwood, FL 32750, Models I and III, \$29.95.

by Michael E. Nadeau

The Search for Elsoliado attempts to combine arcade action with an adventure theme. It succeeds, but the game sacrifices some of the finer aspects of each genre in the process.

You're a disgraced space captain who must find the fabled planet Elsoliado; its riches will rejuvenate a declining empire. You have a ship and 48 credits at the game's outset.

As you travel through space, you encounter space stations, freighters, and many types of hostile aliens. Your screen contains four sections: The up-



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per left is your view screen and the remaining three sections provide you with various information.

In the adventure part of Elsoliado, you accumulate wealth by buying and selling certain items in a way vaguely reminiscent of playing the stock market. You use your wealth to buy information on Elsoliado's location.

This isn't a real puzzle like you'd find in true adventures. You quickly learn when to buy and sell, and once you can afford information, you wait for someone who is accurate.

The arcade aspect comes into play when you encounter aliens. You can offer the aliens part of your cargo or fight them. The object of the fight is to eliminate them before their volleys deplete your fuel supply. You fire at aliens by using the arrow keys to align them with the center of your view screen and firing with your space bar.

In themselves, the battles don't satisfy the criteria for a good arcade game. They're rarely a challenge unless your fuel supply is low.

The game's finish is also a disappointment. Once you discover Elsoliado (it took me about 30 minutes), you must penetrate the forces of Xylol Rex, the planet's warlord protector, and blow up his main reactor.

You chart a zig-zag course similar to many road-race games. Eventually you come upon a # symbol that pinpoints the reactor.

If you shoot this, you return to open space. A congratulatory message appears and the program asks if you want to play again. Not even a thanks from the emperor.

On the plus side, the game is well conceived. You can save up to 10 games in progress. The aliens differ in toughness, and the documentation gives a detailed description of each. In fact, the documentation is almost as much fun as the game.

Elsoliado is only moderately entertaining because of its compromise between an adventure and an arcade game. The first time through is fun, and the concept has potential. ■

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subLOGIC

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Continued from p. 48

sage into the buffers before you call. This reduces your connect time, an important consideration for long-distance calls.

A final advantage is Softcomm's ability to reserve high memory and execute DOS commands. Even if the DOS command returns an error, control usually returns to Softcomm with the error message displayed in full.

Softcomm contains a patch area for any problems that might arise, and the manual states that the normal ROM printer routine isn't used. The addresses for the printer routine in Softcomm appear in the manual, along with some of the important DOS addresses. The manual explains where the printer driver is and what the registers are doing so you can patch in your own routine.

My confusion about this results from the statement made in the copyright notice: "The customer is expressly prohibited from disassembling the supplied software." I consider this statement an

oversight on the part of the author, since without a partial disassembly a patch is difficult or impossible to make.

Stewart Software has a very inventive support idea. Softcomm's author, Bill Stewart, maintains a bulletin board service in Memphis for local Softcomm users and owners. He posts any problems or errors discovered in Softcomm on his system. If you have any questions, you can easily get help. The Softcomm package includes Stewart's bulletin board number.

Summary

Using Softcomm is extremely simple. All command options are self-prompting and straightforward. The 26-page manual that accompanies the program disk is well written, and contains explanations for each command in sufficient detail so that a beginner would have no trouble understanding an option. With Softcomm, Stewart Software has produced a viable entry into the smart terminal field. ■

- A Defines a carriage return character in the eight programmable buffers and allows a time delay after you send the carriage return.
- C Closes the main input buffer. Invoke this command from the keyboard or by the remote system (during downloading, for instance).
- D Displays any of the eight buffers.
- E Toggles between local echo on/off. Generally used with a half-duplex system. Lets you see what you're typing.
- F Displays available free memory in main input buffer—32,767 in a 48K system with no memory size set.
- H Displays this command list.
- I Lets you alter RS-232 parameters (baud rate and stop and parity bits).
- K Saves to disk the eight programmable buffers, the specified carriage return character, the pause time, and the RS-232 configuration.
- L Reloads previously saved parameter files for communication.
- M Sets memory size to protect driver programs. Its drawback is that you reduce the amount of free memory in the main input buffer by the same amount.
- O Manually opens the main input buffer. During information storage in this mode, a pair of carets alternate in the top right corner, indicating data storage.
- P Toggles the printer on or off. Stops printing if the main buffer is open and resumes when it's closed.
- Q Returns to DOS.
- R Converts an expanded binary file in the main buffer back to its true binary form before saving files to disk.
- S Saves contents of main input buffer to disk.
- T Transmits any disk file directly from disk. Suboptions allow automatic opening and closing of the remote systems buffer, transmitting ASCII or binary files, and a file's prompted transmission. After the program completes file transfer, a checksum ensures that the file was received correctly at the remote system.
- W Preprograms any of the eight available buffers. Accepts a maximum of 255 characters per buffer.
- X Executes a DOS command with return to Softcomm. Numbers one through nine transmit any of the eight programmable buffers.

Table 4. Softcomm command list.

★ ★ ★ ½

The Banner Machine
Virginia Micro Systems
13646 Jefferson Davis Highway
Woodbridge, VA 22191
Models I and III
32K cassette, 48K disk
Epson MX or FX printer
with Grafrax or Grafrax Plus
\$49.95

by Eric Grevstad
 80 Micro staff

The Banner Machine uses Epson printer graphics to make sign-making as sophisticated as word processing. It's neither fast nor inexpensive, but it produces top-quality printouts.

The Banner Machine is a long Basic program. "It will take a while to load the tape," the manual advises impatient CLOADers; the Model III disk I tested, which only TRSDOS 1.3 could read, took 30 seconds.

Once running, the program asks a series of questions about the sign you intend to make. Your banner is limited to capital letters, numbers, arrows, and other keyboard symbols (lowercase for a banner is presumably a contradiction in terms). Otherwise, you have a generous choice of artistic options.

You can choose from one of 10 letter sizes ranging from not quite 3/4 inch to 7 inches, and you have a choice of uniformly or proportionally spaced letters (the latter keeps extra space from appearing on either side of an I, for instance). You can put a 1/8- to 1-inch-wide border around your words, and decide where you want its top and bottom lines in relation to the edge of the paper.

While you make these choices, the Banner Machine automatically keeps track of how many lines you have available for text. The program prints signs sideways on fanfold paper. Borderless signs hold 10 lines of small letters, while a Size 1 border with Size 3 letters leaves room for only two lines, and so on.

What you say, of course, is up to you. With parameters set (default values provide proportionally spaced, small-lettered, and small-bordered signs), a cursor indicates your position at the beginning of your first free line, and you're ready to enter up to 54 characters.

The Machine's editing mode isn't

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BANNERS!



Scriptit—the keyboard feels mushy and occasionally drops characters, and a pause occurs after you enter each line before the cursor appears on the one below.

But the arrow keys steer you around your text adequately, and the left and right arrows team with the shift key to handle delete and insert functions. Leaning on the up arrow lifts the sluggish cursor above the text screen to revise format parameters, although you can change letter size only by starting over.

Pressing the shift and clear keys lets you enter special commands. New or N erases everything; Copy or C duplicates an existing line on one below.

Format (F) changes the standard justification, first letter on left margin, of each line. You can center or right-justify (last letter at right margin) a line, or

use Tab to set two columns against the left and right margins respectively, as in a list of items and prices.

The manual, which contains handy samples of every border and letter size, explains your options completely, but is a bit vague on directions for a couple of the Format commands.

The last step is printing your sign. The Banner Machine requires an Epson MX-80 or MX-100 with Grafrax or Grafrax Plus.

Virginia Micro Systems says that the new FX printers support the program, and that a patch is on the way for Star Gemini owners. (I tried printing a sign on a Gemini 15 and got an extra line feed after every printing pass, resulting in spread-out letters like those painted on roads at crosswalks.)

After you've given the print com-

mand and entered the number of copies desired (one to 10), the program displays the reassuring message "I'm working!" while it prepares program instructions—a pause of half a minute for a modest sign, longer for giant banners.

Then the Epson takes over, producing impressively legible, high-resolution hard copy while you have a sandwich or raise a family.

The Banner Machine prints unidirectionally and slowly. A simple "Read 80 Micro" sign with a thin border took eight minutes; a long banner for a company softball game took the better part of an hour. The program's dense dot pattern is also hard on ribbons.

But if you have fresh ribbons and sufficient patience, the Banner Machine makes your words look good. Schools and store owners who have to post a lot of bills and who can afford \$49.95 are probably its most likely buyers, but interested amateurs might like to play with it, too. The banner was better than the softball game. ■

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Electronically Speaking:
Computer Speech Generation
 John P. Cater
 Howard W. Sams & Co. Inc.
 4300 West 62nd St.
 Indianapolis, IN 46268
 Softcover, 230 pp.
 \$14.95

by Jerome I. Weintraub

Electronically Speaking provides you with a great deal of information on speech generation with your computer. The book details the physiology of human speech, the history of synthetic speech, human speech reproduction, and synthetic speech generation. It also reviews current synthetic speech technology, describes a variety of uses for synthetic speech, and outlines the etiquette associated with synthetic speech.

Electronically Speaking uses many photographs, charts, diagrams, tables, flowcharts, wiring circuit diagrams, and



other visual aids to give you a comprehensive guide to speech production. It is technically complete and exact, yet surprisingly easy to read and understand.

If you'd like to develop your own

synthetic speech generator, you'll want to study the chapters that analyze creation of human speech. Cater clearly explains the complex mechanics required to produce various vowel and consonant sounds. The detailed description of the relationship of human to computer speech production shows you what you'll need to make your computer speech sound human.

The book includes tables of the 100 most frequently spoken words and their frequencies, the 39 speech sounds that occur most often, and the relative power (loudness) of 32 speech sounds to help you construct your own synthetic speech system. These tables are followed by a comprehensive list of words you can use to test your system or one you might be thinking of buying.

Some hints help you avoid programming regional dialects into your system. On the other hand, maybe you'd like to know how to give your computer a southern accent.

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to listen attentively and understand its speech. One of the more interesting chapters discusses these issues under the topic of computer speech etiquette.

By etiquette, Cater means getting someone's attention, interrupting, adjusting speech volume to overcome other sounds in the area, and knowing when to repeat something. This chapter helps resolve these issues for a computer speaker.

Speech Generation Types

Cater discusses the three fundamental types of speech generation. The waveform encoder converts actual speech into digital code that you record on disk and play back as you wish. Cater compares this method to a photograph of human speech.

Phonetic synthesis produces synthetic computer-generated speech. This method is like an oil painting of human speech.

Mathematical reconstruction of actual speech (called LPC synthesis) is the technique used by Texas Instruments in their Speak and Spell game and by automobile manufacturers in warnings or safety checks.

Cater deals with these three techniques in great detail. He uses a tachometer analogy to explain the relative bits per second (bps) usage of each: The phonetic synthesis type uses 100-800 bps of speech, LPC synthesis uses 1,200-5,000, and the waveform coding uses 16,000-120,000.

For example, the word *Hello* uses 4-30 bytes for the first speech type, 45-188 for the second, and 600-4,500 for the last type. On a 48K computer, you can store over one hour of speech using the phonetic type, up to 5.3 minutes using the LPC type, and up to 24 seconds using the waveform coding method.

The waveform coding system uses a speech sampling approach, converting each sample to digital code for computer purposes. The more often it samples the actual speech, the closer the computer's speech approximates the human's speech input. Flowcharts, programming samples, and circuit wiring diagrams give you the necessary information to produce waveform coded speech.

Electronically Speaking describes phonetic synthesis in text and diagrams that show you how to get your computer to

produce vowel and consonant sounds that approximate human speech. Cater points out the need for a sufficient number of sounds or phonemes (discrete, fundamental speech sounds) to make the speech more intelligible.

Some commercial synthesizers use only 32 phonemes, while others provide hundreds. You should be aware of this

***"It's not enough
to teach your computer
to speak. You need
to get people
to listen attentively..."***

important characteristic of a commercial synthesizer when shopping for a unit.

The LPC speech method is characterized as "...one of the most rapidly growing techniques for speech synthesis." Because of its complexity, Cater describes only some of the hardware available, and doesn't give the "...10 to 20 pages of...nothing but equations" needed to construct an LPC speech generator; he does provide a bibliography to guide you to the necessary mathematics.

Cater points out the advantages and disadvantages of each system. For example, a disadvantage of LPC is its reliance on a prerecorded vocabulary: "To the home computer enthusiast, the encoding cost of \$20 to \$200 per word becomes rather prohibitive." To an automobile or toy manufacturer who produces thousands of units with the same vocabulary, the unit cost is quite reasonable.

More Information

Chapter 7 describes and analyzes off-the-shelf speech synthesis systems of all three types. Photos, diagrams, and textual descriptions are helpful.

Specific information includes type, size, speech capability, compatible computers, and prices of seven waveform coding systems: Centigram's Lisa, Cheaptalk TRS-80, Computalk Consultants' Compucorder, Micromint's Micromouth, National Semiconductor's Digitalk, Telesensory Speech System's Series III, and Voicetek's Cognivox VIO.

The four phonetic synthesizers reviewed include: Kurzweil Reading Machine KRM, Micromint's Sweet Talker, the Votrax SC-01A, and the Votrax Type 'N Talk. Since I own and use the Type 'N Talk extensively, I can verify that Cater's description of it is completely accurate.

The commercially available LPC synthesizers reviewed include two by Hitachi, three by Telesensory Speech Systems, three by Texas Instruments (including Speak and Spell), the Echo II and Echo-GP by Street Electronics, and two systems by Speech Technology Corp.

Manufacturers' addresses are listed in Appendix C for easy reference if you're interested in sending for literature or ordering units.

If you don't have a computer-produced speech application in mind before you read the book, Cater covers several interesting ideas in Chapter 8. He describes a talking clock, games, fun projects like a Halloween greeting for trick-or-treaters, aids to the handicapped, a talking home security system, and a voice security lock.

As in other chapters, flowcharts describe most of these applications. I'm fascinated by Cater's idea of using the computer to teach a talking bird to speak. You can set up the monotonous repetitions while you're at work, but your bird might sound like a robot when it finally speaks!

Appendix A contains a 14-page glossary of terms, Appendix B is a bibliography, and Appendix D is a collection of 13 everyday working circuit diagrams that you might use separately or in conjunction with other speech synthesis circuits.

This book's only shortcoming, which Cater himself points out, is that the state of the art for computer-produced speech is constantly changing and improving. Although the book is copyrighted 1983, some of the material seems to be late 1982.

All the contents are significant, but future developments could make some of the present hardware obsolete. However, this same comment applies to every aspect of the computer field, so I won't overemphasize it. *Electronically Speaking* is an extremely valuable guide to teaching your computer how to talk. ■

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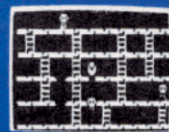


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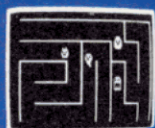
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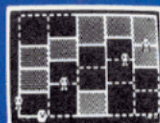
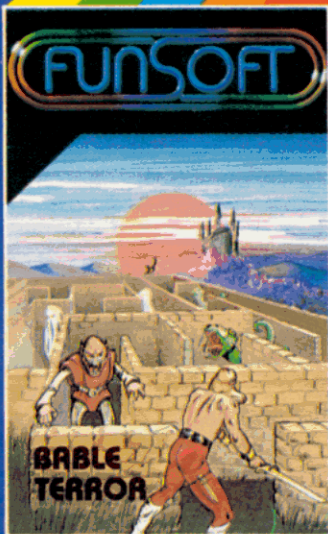


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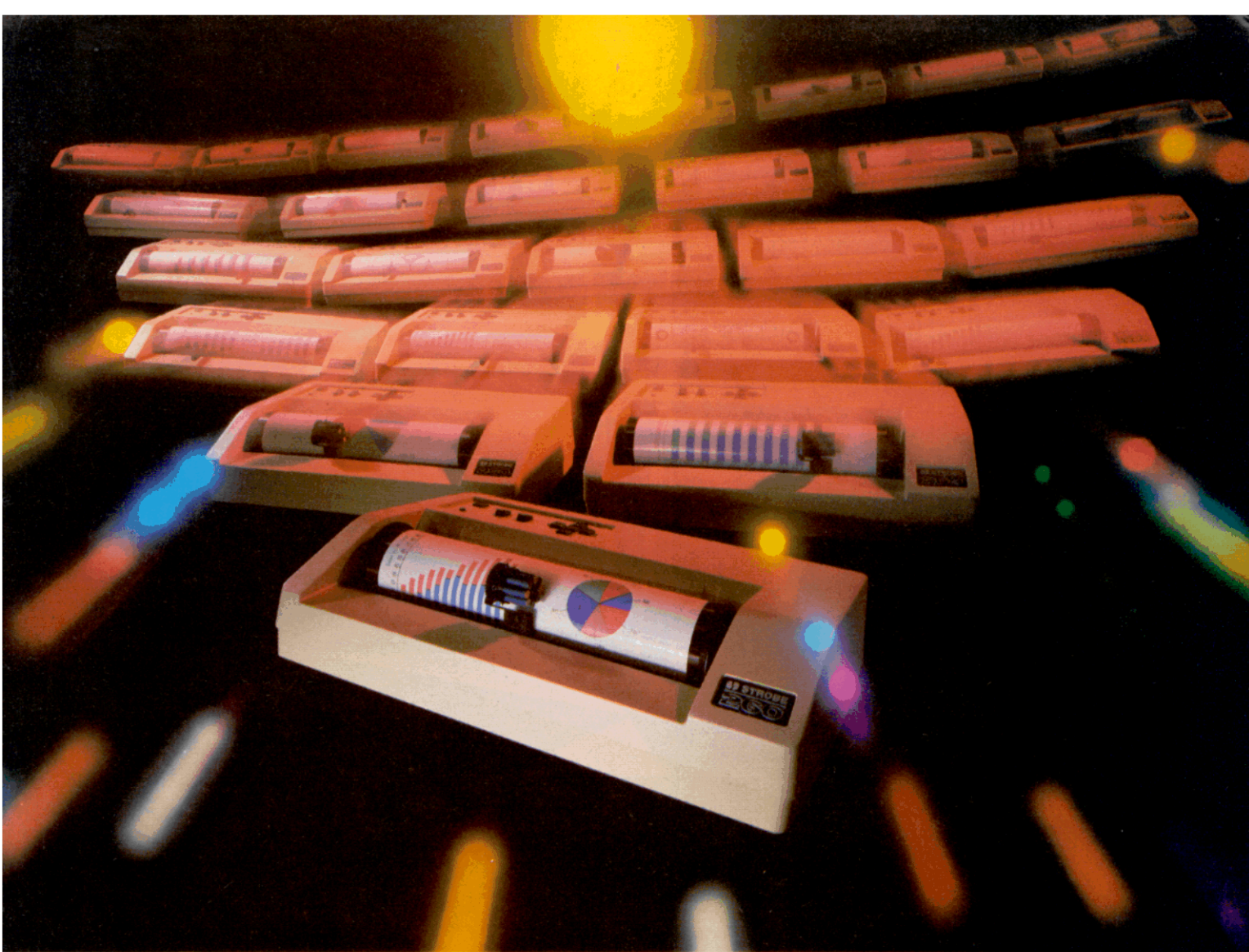
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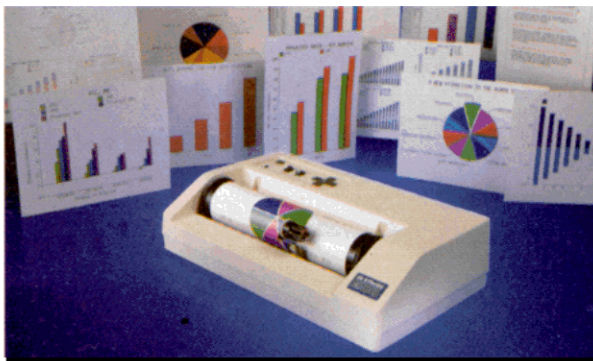
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LED—The LDOS Text Editor (\$29)**FED—The LDOS File Editor (\$19)****Utility Disk #1 (\$39)****Filter Package #1 (\$29)****Filter Package #2 (\$29)****MEMDISK (\$29)****I/O Monitor (\$19)****Logical Systems Inc.****8970 North 55th St.****Milwaukee, WI 53223****Models I and III****LDOS, one disk drive****by John B. Harrell III**

Unlike many of its competitors, Logical Systems Inc. provides its operating system with comprehensive utilities that are totally integrated into LDOS. You'll appreciate how this excellent user support enhances LDOS's powerful manipulation of your computer.

The utilities package I received from Logical Systems contains a wealth of software at affordable prices. I'll present a concise evaluation of each utility so you can judge its worth for your system.

LED—The LDOS Editor

LED is a general purpose screen-oriented text editor that lets you generate standard ASCII files rapidly. It's useful for preparing KSM (keystroke multiply) and JCL (job control language) files. Unlike the Build command, you have full control of entering, deleting, and editing a file.

LED allows easy creation and editing of large ASCII text files. Text files are limited only by the amount of free memory. On a 48K machine, approximately 36K is available for text buffer. This includes preparing text files for EDAS (the editor/assembler, MISO-SYS), Pascal source files, and a variety of other uses. Full cursor positioning and other features such as auto-indentation are available through the arrow keys.

With the LDOS keyboard driver (KI/DVR) installed, all ASCII characters are available from the keyboard. LED displays all characters in the range of X'20' (blank) to X'BF' (large graphics block).

You access all LED's commands using the keyboard's numeric row, the

clear key, and the shift and clear keys. If you must enter special codes not available from the keyboard, LED provides a HEX function to let you enter bytes as hexadecimal (hex) digit pairs.

LED supports generation of KSM files. When you use them with the KSM filter, these files allow entry of phrases with a single keystroke combined with the shift and clear keys. LED allows quick generation of KSM files by providing you with a prompt containing the key labels ready for entry of the string values.

When you complete the KSM file, you can easily remove the KSM labels by using the UNMK (unmark) command to remove the block markers and all data contained between them. LED enters this mode automatically whenever the input file name contains the extension /KSM.

If you've used a screen-oriented word processor such as Electric Pencil, you're already quite familiar with LED's operation. The documentation is of the same high quality as that provided with LDOS, and you'll have no trouble learning the commands.

FED—The LDOS File Editor

FED is an all-purpose file-oriented editor that provides the advanced user with the necessary resources to manipulate files. Even the novice user will find it easy to experiment with FED and learn more about file structure.

The original version of FED is a file editor that doesn't allow manipulation of disk structures at the cylinder/sector level. LSI has announced an enhancement called FEDII (\$39) that provides all these capabilities.

FED has some powerful functions not found in other file editors. These are particularly useful to the Assembly/machine-language programmer. Various functions display the load address of the byte currently under the cursor, locate the byte at the specified load address, and position the file to the beginning of the next load block.

I can't imagine how much time I've spent looking through a CMD file for the appropriate load point to make a modification. This feature is a tremendous help.

LDOS Utility Disk #1

The LDOS Utility Disk provides you with 14 utilities specifically written for

LDOS. See Table 5 for a complete listing of these utilities and their functions.

One of the simplest, most useful routines, High/CMD, displays the value of HIGH\$ (4049 hex) and then displays the load address and name of each active routine. Routines must conform to the linkage specified for LDOS filters and drivers to have displayed names.

This routine, coupled with the Device command, lets you maintain full control of the routines you've activated and the special features in effect.

DCT/CMD displays the Drive Code Table information for any of the eight logical drives allowed in the system. The display is fully formatted and quite comprehensible. Once the information is displayed, you can edit and modify any parameter in the DCT.

You edit by answering basic questions; DCT performs the actual modification of the bit patterns. This is an extremely powerful option for the advanced user.

LDOS Filter Packages #1 and #2

The LDOS Filter Packages #1 and #2 provide a comprehensive set of filters (and some other routines) designed to efficiently process input and output character streams. See Tables 6 and 7 for a complete listing of the filters and routines in each package, with a brief description of each filter's function.

A filter is a machine-language routine that monitors input from or output to a device and performs some special function when it recognizes specific characters. You can use these functions to perform control functions such as shifting printer fonts or to perform an alteration of the data in the input/output stream.

The two most powerful filters, XLATE and MAXLATE, allow code translation of any and all characters appearing in the input/output stream of any device.

Picture the simple task of communicating between computers. If both computers process ASCII data, communication is simple assuming that the machines are properly configured. Now imagine the TRS-80 (in ASCII format) attempting to communicate with an IBM host computer (in EBCDIC format). You must translate information from ASCII to EBCDIC to send it to the host and from EBCDIC to ASCII so it is received by the TRS-80.

XLATE can easily perform this

function using a translation table. Translation tables for XLATE and MAXLATE are ASCII character files containing the replacement instructions. You can create them using the Build command or LED.

MAXLATE expands the power of XLATE by allowing the substitution of zero to 255 characters (bytes) for any intercepted byte. For example, MAXLATE can automatically expand simple 1-byte control codes into the multibyte sequences required to control your

printer's special features. MAXLATE provides all XLATE's other functions as well. The power of this filter is boundless.

One excellent feature of both filter disks is inclusion of the source code for all the filter files in EDAS assembler format. You can easily modify any of the filters to include features important to you. This is a valuable way to study the principles of good programming. Each of these source files is well written and highly documented.

MEMDISK—Disk Drive in Memory

It's exceptionally easy for an advanced programmer to integrate anything into the LDOS system due to its clear technical documentation. The MEMDISK/DCT driver provides evidence of this by implementing a small RAM disk in high memory (the user selects variable size).

MEMDISK is easy to install using the System command and functions similar to any other disk drive. All standard disk input/output commands operate

File Name	Description
COMP/CMD	Compares two files, parts of files, disks, or parts of disks in a character-by-character match, displaying areas where the two don't match.
DCT/CMD	Displays the Drive Code Table for any of the eight logical drive numbers to the screen. Allows direct modification of the DCT.
DIRCHECK/CMD	Checks the disk directory for errors and displays error summary. Attempts to fix detected errors.
FIXGAT/CMD	Attempts to repair an unusable Granule Allocation Table (GAT) in the directory of an LDOS formatted disk.
HIGH/CMD	Reports the addresses of routines using high memory addresses and the current value of HIGH\$. If routines conform to the LDOS standard, reports the name and entry point of each.
MAKE/CMD	Allows creation of a disk file filled with the character of your choice.
MAP/CMD	Lists the allocation of existing (and some deleted) files by extent, cylinder, sector, and granules.
RAMTEST/CMD	Performs a read/write/verify test of all user memory.
RDTEST/CMD	Reads the entire disk to see if it is totally accessible.
READII/CMD	Performs the transfer of Radio Shack Model II formatted disks to an LDOS formatted disk (requires 8-inch disk drives).
READ40/CMD	Used in conjunction with Format, Backup, Copy, and CONV, allows reading a 35- or 40-track disk in an 80-track disk drive.
TYPEIN/CMD	Lets the user construct a sequence of characters that acts to control the operating system or an applications program. Similar to the use of JCL, but TYPEIN lets the user control programs using keyboard routines such as INKEYS.
UNKILL/CMD	Reinstates a specified file previously deleted by using Kill or Purge.
WRTEST/CMD	Writes to a previously formatted disk to verify that the disk is accessible.

Table 5. LDOS Utility Package #1.

File Name	Description
CALC/FLT	A keyboard filter used in conjunction with KI/DVR to perform hexadecimal/decimal/binary conversions and hexadecimal arithmetic.
LINEFEED/FLT	An output device filter to remove or add a line feed (0A hex) after each end-of-line character (0D hex).
LISTBAS/FLT	A filter used with the display or printer to restructure the appearance of packed Basic programs.
LOWER/FLT	Two filters used with any device to convert alphabetic characters in the range of A to Z to all upper- or lowercase letters.
MONITOR/FLT	Filters any device capable of output, monitors for special characters, and substitutes special symbols for the characters.
PAGEPAWS/FLT	Filters the printer output and causes the system to pause whenever a top-of-form character is encountered, allowing page changing.
REMOVE/CMD	Reads a specified file and removes all the specified characters. Essentially a copy function with bytes matching the specified pattern not copied.
SLASH0/FLT	Allows those printers capable of backspacing to print a slashed zero character if that character isn't part of the normal character set.
STRIP7/FLT	Used with any device to strip (remove) the high bit off each character passed, converting characters outside the normal ASCII range to ASCII.
STRIPCNT/FLT	Applied to any output device to convert control characters and characters outside the normal ASCII range to a pound sign (#).
TITLE/FLT	Used with the printer to allow titling of printed output. You can include the system date and time as part of the title.
TRAP/FLT	Used with any output device to trap and throw away any character passing through it.
XLATE/FLT	Used in the input and output path of any device to perform a code translation. Two translation tables convert the keyboard into Dvorak and translate to/from ASCII/EBCDIC codes.

Table 6. LDOS Filter Package #1.

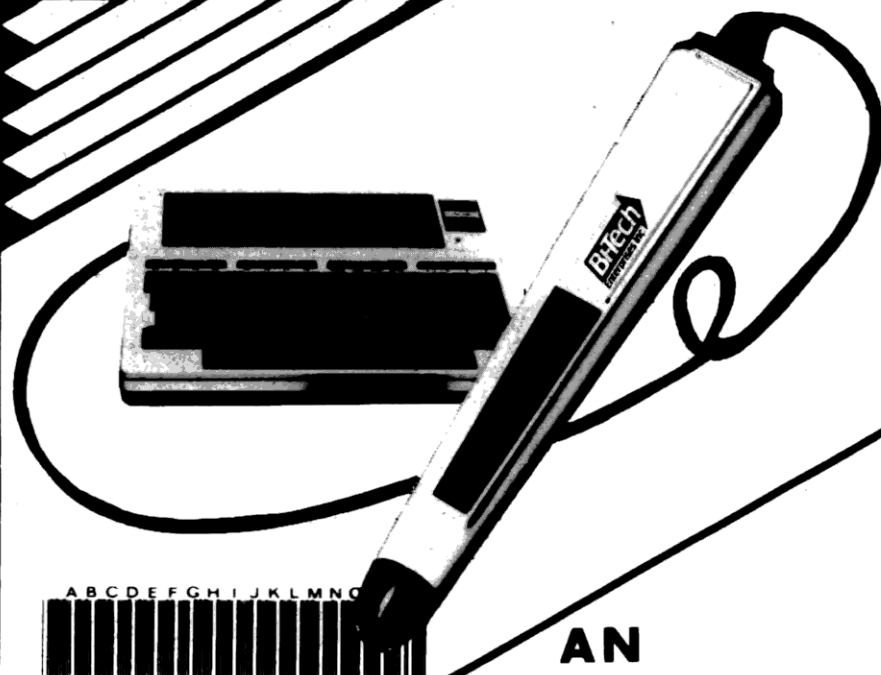
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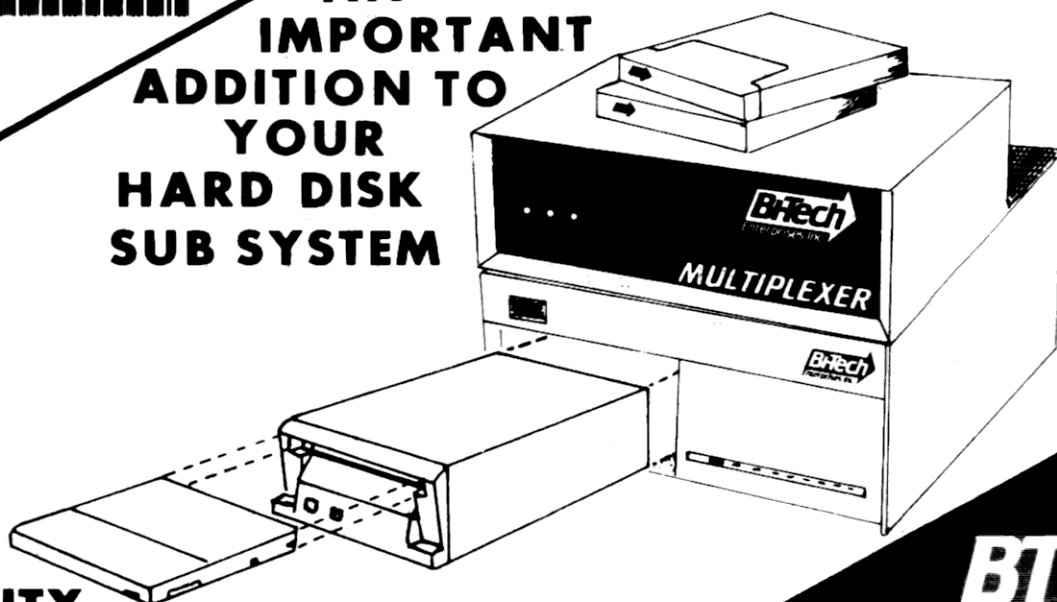
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on MEMDISK, with the exception of functions such as Backup and Format that are specific to floppy drives.

MEMDISK consists of a short driver program and the memory allocated for disk storage. MEMDISK allocates disk tracks with one or two sectors (256 bytes) per granule, and each track consists of six granules.

This means that each track takes 1.5K or 3K bytes respectively. The number of granules per track and the number of tracks are selected after the driver is initialized on loading.

Forcing the disk operating system to use a combination of MEMDISK and system resident files as the system drive provides an overall speed increase that's hard to believe.

It isn't possible to copy all the disk

"Monitor aids in the recovery of a file that has a parity error."

operating system files to MEMDISK due to the file allocation methods used for disk files and the system's memory constraints.

For example, none of the system modules are exact multiples of 1.5K and each file contains wasted space. Therefore, the memory resources are expended rapidly. Also, because SYS6/SYS and SYS7/SYS (the library files) are ISAM (indexed sequential access method) files, you can't force them to reside in memory using the System

(SYSRES = x) command.

If you combine the features of the MEMDISK driver and the SYSRES option, you can store the entire disk operating system files in memory (on the MEMDISK or as resident system files). Once you've accomplished this, the System (SYSTEM = x) command can force execution of the operating system from MEMDISK and the files resident in memory. You can then remove the system disk in drive zero.

MEMDISK is also available on the Model 4 under TRSDOS 6.0. This lets you use the additional 64K of available memory for a RAM disk and increase system execution speed significantly.

I/O Monitor

The I/O Monitor monitors disk input and output operations, intercepts disk read and/or write errors, and offers you error recovery options.

Part of Monitor's operation is the display of a long form error message containing the error number with a full length error description, the filespec of the errant file, and the address of the call to the disk I/O routine.

You then have the option of ignoring the error, retrying the operation, continuing with the application program, or aborting the current program. These options provide valuable opportunities for you to manipulate files that otherwise might not be available.

For example, Monitor aids in the recovery of a file that has a parity error. Normally, reading this file gives a PARITY ERROR DURING READ message when the program encounters a bad sector. By ignoring the error during a file copy operation, Monitor transfers the file with no parity errors.

Some sectors might still have bad information, but FED can reconstruct them. This is an exceptional time saver when you're manipulating large files.

The Bottom Line

Many software houses produce good operating systems for the TRS-80. However, Logical Systems provides full support of the operating system, full user services, completely integrated utility support, and a desire to please their paying customers.

Their LDOS utilities are reasonably priced and, best of all, they work exactly as documented with no modifications by the user. ■

File Name	Description
COMM1/FLT	A communications filter designed for use with the LDOS RS-232 drivers. Provides testing for modem carriers, delay between characters, and line feeds and nulls after carriage returns.
DICTATE/FLT	Provides the ability to turn on/off the cassette recorder from the keyboard. Allows a typist to type dictation from the cassette recorder into a word processor.
DOSPEED/FLT	Regulates the speed of any LDOS output device, controlling the rate of characters output to the device. Useful for regulating the speed of the video display while allowing a long file listing to scroll.
KSMPLUS/FLT	Works essentially the same as the KSM/FLT provided with LDOS. Extended features include editing the KSM filter table, recall of date and time, and recall of the last LDOS command.
LCOUNT/FLT	Writes a line number preceding every line of text written to an output device.
MARGIN/FLT	Provides an additional method of establishing the left margin of printer output. Allows output of control codes to the printer, if needed, prior to printing the blanks for the left margin.
MAXLATE/FLT	Used with any device to provide translation of any byte (user defined key) into a group of characters from zero to 255 characters in length.
SLOSTEP/DCT	A high memory disk driver to allow proper functioning of certain disk drives.
VIDSAV/CMD	Provides the capability to store the contents of the video screen in memory and swap screen contents with the stored screen at the touch of a key. Proper use of the control codes allows similar processing from Basic.

Table 7. LDOS Filter Package #2.

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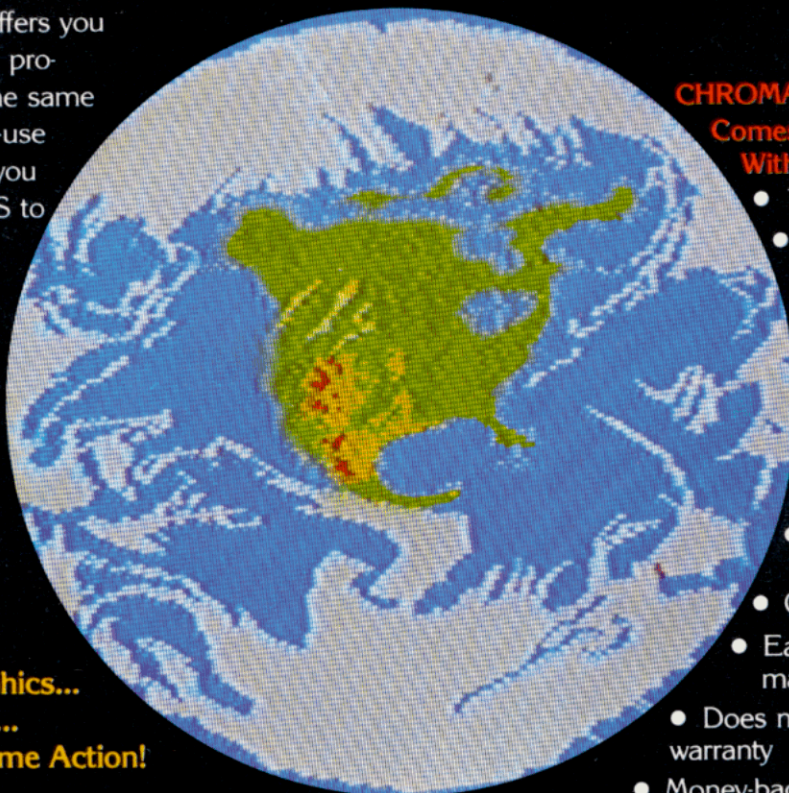
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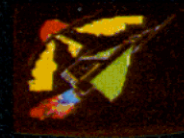
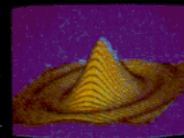
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Quill
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Model 100
\$24.95 cassette
by Scott L. Norman

The Model 100 sorely needs an auxiliary program to format printed output. Its built-in Text program has only one formatting command to control the length of a printed line.

Quill is a compact Basic program for the Model 100 that does the job. It gives you control over margins, line spacing, page length in lines, numbers, footers, and right justification. The footers are right-justified after the page numbers at the bottom of each sheet.

Quill is completely menu driven, and is small enough (roughly 1K) to be left permanently in memory. Since it's written in Basic, you can easily customize

the default settings for various format parameters.

You load and save the program just like any other Model 100 Cassette Basic file: type in LOAD"CAS:QUILL.BA" followed by "SAVE QUILL.BA". To use it, point the cursor to QUILL.BA on the computer's main menu and hit the enter key. The program prompts you for the name of the do-file you want printed, then displays the format menu.

Quill has defaults for all nine format parameters, and controls them with the computer's eight function keys. You can change a default for a single printing session by pressing the associated F key. F3 redefines both the top and bottom margins.

If you want to change one of the pair, you have to specify the other as well. When you're satisfied with the parameters, press the enter key to print.

The default parameters include double line spacing, the left margin at six spaces, the right margin at 70 spaces, top and bottom margins of four lines, 1

as the first page number, the page length equal to 66 lines, no right justification, and the footer equal to the file name.

Each parameter is associated with a Basic variable defined in a single line of the program. If you edit the line and exit to the Model 100's menu, you save your customized version of Quill; the eight-page instruction leaflet shows you how.

Most of the text I generate on my Model 100 is draft material, so I prefer a left margin of 10 spaces and a bottom margin of six lines. It took me just a few moments to change the program line accordingly, using Basic's Edit function. I can always override my new settings for any particular printout: I might like single spacing and right justification for correspondence.

Quill is essentially a Basic character-counting routine, so you might expect it to slow up printing operations. It does, but not by much.

As a test, I printed a 335-word file with the standard Print command and with Quill. I used my old Line Printer VII at 600 baud, and kept the number of

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line feeds constant by specifying a line length of 60 spaces for both printouts.

I set up Quill for single spacing, no justification, and a top margin of zero to further equalize the amount of print-head motion. I set left and right margins at 10 and 70.

The standard Model 100 printout took one minute and 17 seconds, while Quill required an additional 23 seconds. This isn't a trivial difference, but the Model 100 is still faster than my big writing machine, a Color Computer with Telewriter. Of course, the Model 100's parallel printer port has something to do with that.

Quill is a straightforward program that fills an obvious need. Its use quickly becomes intuitive; in fact, the existence of default settings means that most users won't have to think about Quill at all once they install it. Quill is a worthwhile acquisition for text-oriented Model 100 users.

Quill includes a second program, Size, that counts the number of characters in a do-file.

Prospective Quill users should be aware of one limitation: The program doesn't recognize Model 100 tab codes

so you should indent paragraphs by hand, using the space bar. It won't print most graphics characters either. ■

★★★★★

Radio Shack DMP-2100
Tandy/Radio Shack
One Tandy Center
Fort Worth, TX 76102
Computer with standard parallel
Centronics
\$1,995

by Jerry L. Latham

The Radio Shack DMP-2100 printer rivals daisy-wheel printers and IBM Selectrics that use standard ribbons. The secret of the extraordinary capabilities is the print head. Instead of the usual seven-, eight-, or nine-wire print head, the DMP-2100 uses a 24-wire print head. The fine print wire makes a dense character, and thus, a

high quality of print in certain modes.

The printer has several print modes: standard 10 characters per inch (cpi), standard 12 cpi, condensed 16.7 cpi, proportional printing, correspondence 10 cpi, and correspondence 12 cpi modes. A normal or elongated (double width) character print option is available for each mode. The printer also has two dot-addressable graphics modes.

The printer's maximum speed is 192 characters per second (cps) in standard 12 cpi mode. The slowest speed is 26 cps in elongated correspondence 10 cpi mode when set to print two or three carbon copies. In the proportional mode, the average speed for a single-part document is 100 cps.

Depending on the mode you select, the DMP-2100 prints anywhere from 68 to 226 characters per line. The standard

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length is 136 characters, and in the proportional mode you get an average of 174 characters per line. Maximum line length is 13.6 inches.

The printer's character set includes the standard alphanumeric and punctuation characters. Additionally symbols for pounds sterling, cents, one-quarter, one-half, three-quarters, copyright, trademark, and registered trademark are included.

Some scientific, some word processing, and some foreign language characters are also included in the character set. Characters 224-254 decimal are a special group of limited use graphics characters (see examples in Fig. 1).

The printer switches from one mode to another through software control. Control codes perform operations such as backspacing, form feed, begin and end underlining, half or full forward or reverse line feeds (for super- and subscripting), and executing a 1/20 or 4/5 forward line feed. The DMP-2100 also has a bold (double strike) print capability.

You can use control code sequences to enter and exit either of the two graphics modes. However, you can't use some control codes in the printer. An hourglass symbol on the paper tells you that the computer doesn't recognize a certain control code. The most notable of these codes is **09** (horizontal tab).

Another quirk is that it's difficult to print a slashed zero because the printer handles the backspace character (08) in a unique way. Instead of backspacing one character width, then printing the next character received, the DMP-2100

looks for a dot count to follow the 08 code. It backspaces that number of dots, then prints the next character. This machine needs a hardware switch to provide a slashed zero.

Graphics

With its fine print head and graphics abilities, this printer has incredible graphics possibilities. The two graphics modes include a 7-bit, low-resolution mode, and a high-resolution mode. The 7-bit mode is the standard graphics mode as in other Radio Shack printers. The high-resolution mode takes advantage of the DMP-2100's almost unique 24-wire print head.

Positioning the print head requires that you specify the number of dot widths to space over before printing a graphics code. The low-resolution mode has 816 addressable dot columns across a single line, and you address any of seven dot positions in a column.

You use the low resolution mode by entering a CHR\$(18) command. Position the print head with a control 16 n n sequence, and begin entering your graphics. Because you can't specify a number larger than 255 in a single byte, you must use a special two-number sequence that tells the printer where to go on the line.

First, send the printer a control character, CHR\$(27), followed by a CHR\$(16) to prepare it for 2 bytes of data that specify where it positions the print head. The next byte of data must be zero, 1, 2, or 3. The second byte of information can be in the range of 0-255 if the first byte is zero, 1, or 2. If the first

byte is a 3, the second must be in the range of zero through 47.

This divides the page into three 256-column areas, and one 48-column area. The first byte after the control sequence tells the printer to which general area to go and the second byte specifies the exact dot within that area.

You enter the high resolution mode by sending the printer control characters CHR\$(27) and CHR\$(73), followed by the dot position information in 2 bytes. In this mode, you have 2,448 points across the page, and you can use any of the 24 print head pins.

For dot positioning, your line is now divided into 16 separate areas. The first 15 are 256 dots wide and the last is 240 dots wide. The first dot-positioning value byte must be in the zero to 15 range, and the second byte in the zero to 255 range for first byte values of less than 15, and in the zero to 239 range for a first byte value of 15.

To pick out separate print wires to fire, you send the printer 3 bytes of information: 1 byte for the top group of eight wires, 1 for the second group of eight wires, and the third for the lowest group of eight wires on the head.

You can mix dot-addressable graphics with standard print, and dot positioning the head is possible in standard text modes. The special line feed commands give you solid looking graphic print outs.

Evaluation

The manual that comes with the printer is filled with typographical errors. However, so far the manual hasn't

THIS IS THE STANDARD 10 CPI MODE
THIS IS ELONGATED 10 CPI MODE
Bold Elongated 10 CPI Mode

THIS IS STANDARD 12 CPI MODE

THIS IS ELONGATED 12 CPI MODE

This is done in the condensed (16.7) character mode

This is elongated condensed character mode

This is correspondence 10 CPI mode

And this is the proportional print mode

Here come the special characters available, in 10 CPI mode:

Followed by the special graphics characters:

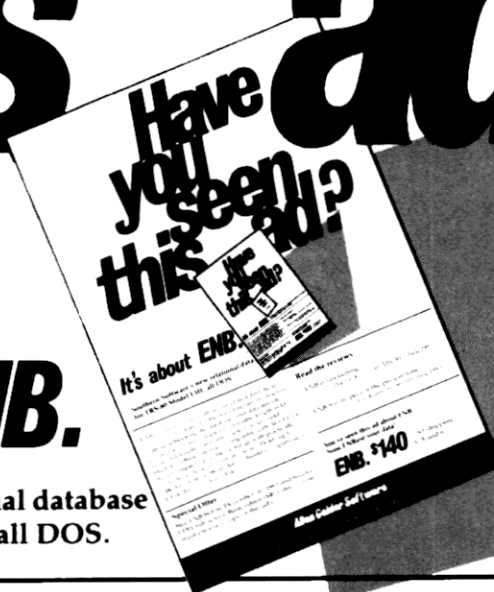
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Figure 1. Sample print modes and special characters.

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misled me.

The hardware is more carefully constructed than the manual. It comes in a grey case, and is 21.7 inches wide by 15 inches deep by 5.9 inches high without sheet feeder or tractor feed. The DMP-2100 weighs in at 42 pounds. You can switch it between 110V/60Hz and 220V/50Hz for overseas travel.

The print head is rated for 200 million standard 10 cpi characters. Depending on whether your paper is single thickness or multicopy, it handles paper from 10 to 22 pound weight, in widths from 4 to 15 inches.

Controls on the printer are somewhat limited. An eight-position DIP (dual in-line package) switch inside the cover lets you choose the default parameters for print style, character set, and line feeds.

On the front of the machine are four controls: Test, Paper Feed, Restart, and On/Off Line. The Test and On/Off Line switches are obvious, but the other two deserve a few words.

The Restart control clears the out of paper alarm and the carriage overrun error. It also clears the paper jam alert condition, and stops the self-test func-

"Overall, I am impressed with this printer. It's fast and rivals many daisy-wheel printers in quality. You also have the added plus of dot matrix versatility."

tion. In most cases any data in the 136 character buffer is lost when you use this control.

You can use the Paper Feed control when the printer is off line to advance the paper. Pressing and quickly releasing this control advances the paper 1/24 inch. Holding down the control continuously advances the paper.

The printer doesn't have a specific form feed control. Press in and turn the large carriage knob to align your paper. You can do this with the printer in the on or off line mode.

Four indicator lights on the front panel include separate Power and On

Line indicators, an Alert light, and a Paper End light. The Alert light handles all error conditions except Paper End.

Although the printer comes set up for friction feed paper, tractor feed is available at a reasonable price. The tractor feed is very reliable as long as the tension bar isn't so tight that it causes page slippage.

The ribbons for the DMP-2100 list for \$13.95 each and are rated for 3 million characters. I assume that's 3 million characters in standard 10 cpi mode. In the word processing mode using proportional print, the ribbon starts getting noticeably dim after about 100 pages. A ribbon re-inker is a wise investment with this machine.

Overall, I am impressed with this printer. It's fast and rivals many daisy-wheel printers in quality. You also have the added plus of dot matrix versatility.

Some improvements are still needed, but they're not in the area of print quality or dependability. If you're ready to spend over \$2,000 for a printer capable of business correspondence quality printing, this is one machine you should seriously consider. ■

★ ★ ★ ★

Speed-Up Kit 2.X
Racet Computes Ltd.
 1855 West Katella Ave.
 Suite 255
 Orange, CA 92665
Models II, 12, and 16
\$99.95

by Caddy McCall

The Speed-Up Kit from Racet Computes is a series of enhancements to TRSDOS 2.0, 2.0a, and 2.0b that considerably improves some of the operating system's more exasperating quirks. Its main accomplishment is speeding up TRSDOS's notoriously slow performance.

The kit isn't available for TRSDOS II 4.1, but it lets you use double-sided drives on the Models 12 and 16.

The Speed-Up Kit first changes the date and time entry routine. You make these entries only once when you turn on the system, and don't need to enter them again unless you turn off the system. Each reboot bypasses the request

for date and time, and uses the current settings.

The Verify Detect patch makes the system run faster than it normally would without Verify Detect while retaining this feature. The Logo patch eliminates the logo when you boot up TRSDOS.

With the Diagnostics patch you choose whether TRSDOS performs the diagnostics routines at each boot, only on power up, or not at all. The Fast System Load patch loads the system from your disk at five times normal speed.

On the Models 12 and 16 with double-sided drives, TRSDOS 2.0 can

access both sides of the disk. This is implemented as four single-sided drives rather than two double-sided drives.

You can assign drives zero and 2 to the left drive, and drives 1 and 3 to the right drive. This arrangement maintains total compatibility with your present system.

You can also assign drives zero and 1 to the left drive, and drives 2 and 3 to the right drive. This arrangement runs programs that require two drives, using only one real drive.

With the installation program, almost any arrangement is possible. Since you load the assignments at boot-up, you can boot one set of assignments on one disk and a different arrangement on the second disk. (This is confusing and I don't recommend it.)

Selecting the double-sided drive option displays a graphics image of the selections made. You verify that the assignments are what you want. This function helps beginners understand the concept of logical and physical devices. It's convenient for people who have trouble creating mental images of their logical assignments.

Verify	Detect	TRSDOS 256 Byte Records	Racet 256 Byte Records
On	On	62	43
On	Off	51	41
Off	On	46	26
Off	Off	36	25

Table 8. Seconds required to copy 100 records.

I don't recommend using the Verify off mode.

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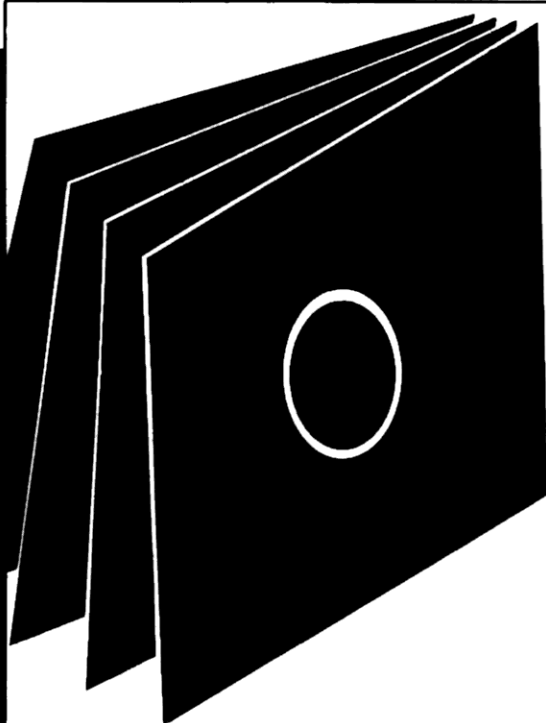
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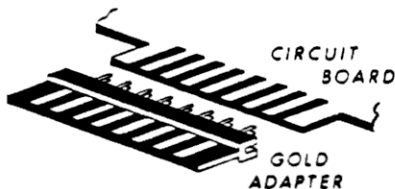
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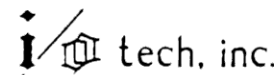
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REVIEWS

TRSDOS 2.0 recognizes only four logical drives. If the system contains more than two double-sided drives, you can't use the extra drives.

Speed

My main interest in this product is the increased speed of TRSDOS 2.0's disk access. Depending on the type of records you process, the difference in time is astounding. The kit improves TRSDOS's speed by changing the disk access routines in the operating system.

You can't copy Racet's distribution disk but the company will replace it for \$15 if damaged. It has one feature I haven't seen before.

Two copies of the patching program are available. Only one of them is accessible to you, but a special recovery program lets you restore the original from the back-up copy. This assumes no physical damage to the disk surface.

If you want to modify many TRSDOS disks in the same manner, the Speed-Up Kit has provisions that modify the installation program so it automatically applies your upgraded system to each disk.

The Racet license agreement doesn't limit the number of system disks it lets you modify. To make back-ups easier, the modifications carry through the back-up procedure to the new disk.

An additional installation feature is a

patching program that upgrades each registered user's systems as Racet releases future patches.

Scriptit 2.0 requires a special patch that is supplied. This requires that you apply two 1-byte patches with the TRSDOS patch utility. If your system needs these patches, remember to use a do-file to install them.

Also remember to make a copy of your working system before applying the patches. Always make patches to an extra copy, never to your working copy or to your original distribution disk.

Using a do-file considerably reduces the tension involved in patching because you can check and recheck the accuracy of the patch as many times as you want before actually installing it. After installment, your do-file contains a record of exactly what was done in case something doesn't work as expected.

Using the Racet Speed-Up Kit requires booting up the system with a Racet modified disk on logical drive zero. The initial sign-on messages identify disks as containing the Racet modification. Other than that the only difference is increased speed.

The Racet system requires no additional memory, but the contents of D000-EF00 are destroyed during the boot. This will concern you only if you work with machine-language program development. You can use an unmodi-

Fixed Length Records Record Length in Bytes

System	Verify	Detect	1	4	16	64	256
TRSDOS	On	On	60	87	180	566	1767
Racet	On	On	60	87	127	467	400
TRSDOS	Off	Off	60	70	127	400	1770
Racet	Off	Off	67	87	127	430	400

Table 9. Relative time required to read data files from Basic programs.

I don't recommend using the Verify off mode.

Fixed Length Records Record Length in Bytes

System	Verify	Detect	1	4	16	64	256
TRSDOS	On	On	73	140	380	1300	3460
Racet	On	On	67	110	240	933	2030
TRSDOS	Off	Off	60	90	190	593	1770
Racet	Off	Off	67	87	130	520	400

Table 10. Relative time required to write data files from Basic programs.

I don't recommend using the Verify off mode.

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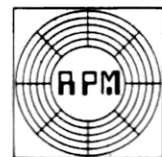
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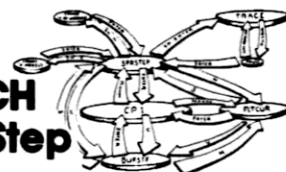
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REVIEWS

fied TRSDOS disk to boot up if it's necessary to retain the contents of this memory segment.

The Racet speed-up modification is good, but not an unqualified success. The disk access improvements are more noticeable when writing a file than when reading one. They are also proportional to the length of the file records.

Only a very slight improvement oc-

curs in handling files with 1-byte record lengths. As the record length approaches 256 characters, however, the improvements become very noticeable.

The Racet Speed-Up Kit has considerably reduced the frustration of using TRSDOS on my machine. I recommend it to anyone running applications of the Model II, 12, or 16 using a floppy system with TRSDOS 2.0. ■

★★★★ 1/2

What Do You Do After You Plug It In?

William Barden Jr.
Howard W. Sams & Co. Inc.
4300 West 62nd St.
Indianapolis, IN 46268
Softcover
\$10.95

by Mary Gasiorowski

Finally, a comprehensive but enjoyable and easy-to-read book for beginners on what computers are, how to pick one, and how to use one effectively.

Bill Barden suggests that *What Do You Do After You Plug It In?* answers the questions a person who has just bought a personal computer asks. This is also an excellent book for the person who hasn't yet made the investment for a computer system.

What Do You Do After You Plug It In? covers the major areas of computer hardware, software, and applications in detail. The first chapter is especially good if you're looking for information before buying. It divides computer users into groups by the type of applications they need, and makes specific suggestions for each group.

A computer system for home use, for example, can be fairly small and reasonably priced, allowing for upgrading at a later date. A small businessman needs to be more concerned with speed of operation, storage capacity, and applications software.

Are the new 16-bit computers twice as good as today's 8-bit computers? This question has no simple answer, and Barden presents both sides of the argument clearly. He explains the workings of and options for internal (RAM and ROM) and external (cassette tape, floppy, and hard disks) data storage, as

well as several newer developments.

Barden describes different types of printers, some special features, and items to watch out for when purchasing a printer. He discusses who needs high-resolution graphics and who doesn't. He outlines additional devices that can be useful: plotters, digitizers, light pens, and clocks.

The section on software presents a brief history of computer languages, offers advice for choosing a language, explains the operating system, spells out the pros and cons of developing your own software, and provides tips on buying (and otherwise acquiring) software.

For novices, the organization of the chapters in this section could be better. Beginning the section with the chapter on programming languages gives the impression that an active choice and perhaps knowledge of that language is necessary to use a computer.

Many applications, such as book-keeping, are possible without knowing a word of a programming language. The chapter on buying software might make a better beginning.

The third section explains disk files and those computerese terms, record, field, variable length, random access, and ISAM, as well in 10 pages as I've seen anywhere. The next chapter covers vital back-up procedures—the whys and whens.

Barden doesn't ignore one of the more powerful and useful aspects of computer use, telecommunications. He makes it easy to understand the technical considerations and the different features available. Finally, he outlines the present difficulties in getting the computer to talk (speech synthesis), to listen (voice recognition), and to control your home lights, heating, and lawn sprinkler.

The section on applications would be richer if it included explanations of

more popular applications, such as word processing and electronic spreadsheets, in addition to the technical system information it now contains.

One aspect of *What Do You Do After You Plug It In?* makes me slightly hesitant. Barden's expertise on the many computer systems isn't crystal clear.

In some cases he tosses around the various computer names as if he knows all their features well; in other places he quotes an example based on one system or one specific brand of peripheral

"Barden provides general and detailed information; he answers the necessary questions to make the computer novice comfortable..."

device—a quotation that, as worded, isn't applicable on other systems. However, as long as you're reading *What Do You Do After You Plug It In?* for gen-

eral information, this is no problem.

What Do You Do After You Plug It In? is a worthwhile book if you're just beginning to explore computers. Barden provides general and detailed information; he answers the necessary questions to make the computer novice comfortable with his system.

He explains the major computer terms, and discusses the advantages and disadvantages of the many options. His informative and humorous style makes reading this book an enjoyable experience. ■

★★★★

The Benchmark 3.0M
Metasoft Corp.
711 E. Cottonwood, Suite E
Casa Grande, AZ 85222
Model II, CP/M
\$499

by Charles R. Perelman

The Benchmark is a sophisticated, comprehensive word processor for CP/M systems. It offers a wealth of performance options that are flexible and easy to learn. It performs well in a business environment with heavy and varied word processing demands.

Benchmark's many functions and single-key commands are easy to learn. The program runs smoothly with logically organized menu panels and a good help screen. It offers a variety of form features and formatting controls are extensive.

Installation for a Model II with CP/M requires only a menu selection. The drivers accommodate most widely used printers and terminals, and 5¼- and 8-inch disks are available. Dual disk drives help you make a copy of the distribution disk and get the most out of the software, but Benchmark also runs on a single 8-inch drive.

A minimum of 64K of memory suffices for typical CP/M systems. With its run time module, Benchmark occupies about 108K of disk space. To take advantage of complex Benchmark formatting, you need a full-function printer.

Using Benchmark

You enter the system through a series of menus that let you name your file

with up to 30 characters, then date and tag the document with the author and operator names. Edit an existing document by accessing the directory that lists file names, date begun, latest revision date, and size.

You select the overall function: Create, Revise, View, Print, Merge, or additional specialized procedures. Then specify the working file by document number.

With the View option, you make changes in a file and print it out as modified without changing the original document or saving the revised file to disk.

Additional procedures include ASCII formatting; time, date, and storage unit assignments; indexing; and deleting files. The program increments the alphabetical version letter and you choose whether to retain the old file for backup on completion of each edit.

Before file changes become permanent, you must either execute or cancel the modifications. This safeguards against inadvertent errors, especially for a beginner. However, you sacrifice the speed of a word processor that acts immediately upon command entry.

Initial set up creates a data storage unit, a CP/M file that contains all the documents you produce with Benchmark. Each floppy drive can exist as a separate storage unit and you can divide a hard disk into several units.

This is one of Benchmark's unusual aspects. Files aren't in ASCII format, and CP/M facilities can't read them directly; a Benchmark utility converts the files to and from ASCII.

One of your first tasks is to identify Execute and Cancel command keys. The TRS-80 Model II with Pickles and Trout CP/M assigns these functions to

hold and escape keys. I quickly became accustomed to their use. The location of designated keys affects Benchmark's convenience.

Benchmark operates at two levels: In the control mode you choose the operation you need, and in the active mode you alter text. Except for creating a document, which puts you into Insert, the keyboard isn't initially active and you choose a command to begin operation.

Commands operate when you press a single key, generally the first letter of a descriptive word. The plain English terminology of the commands is helpful. Pressing the question mark key calls up an alphabetically ordered help screen.

Benchmark assigns edit functions to terminal function keys. In addition to the arrow keys, you can use the numeric keypad for alternate cursor movement. This is particularly useful if your arrow keys are not in a convenient cross arrangement and if your numbers repeat when you hold them down.

Single stroke commands move the cursor to the top, bottom, or next screen. Benchmark monitors the page number at the top of the screen, and you can jump to any page in the document. Enter a number higher than the last page to jump to the file's end. Depending on the file size and distance from the current page, jumping might generate some disk thrashing.

For line width format exceeding 80 spaces, the screen scrolls horizontally as required. You can abort an Edit or Erase command to the end of a file with one key, but you must confirm the choice before the program acts.

Deleting, moving, copying, and exchanging text is consistent, so you master the technique rapidly. Benchmark

highlights affected text with inverse video before you execute a command for permanent change. You make interactive insertion mode changes by backing up the cursor to delete text.

Benchmark contains full facilities to locate and format multiple line headers, footers, and footnotes with automatic page and footnote numbering. The default setting doesn't number pages. At any point in the file, you can insert non-printing directions or comments.

The search and replace functions are thorough. You decide on matches with or without regard to upper- or lower-case, for whole words only, with question marks as wild cards for one or more letters, for any digit, or for paragraph terminators. Automatic global replacement is optional.

Interactive printing lets you produce a printout of the screen at any time, and print any part of a document without first saving the file. This is a convenient feature that makes testing the appearance of a portion of your document quick and easy.

You toggle print control status, noted at the screen's upper right corner, from off to single-page to continuous printing (to end of the current document) by using the P key. In the separate print mode you must start at the beginning of each file, but you can interrupt printing at any point. You can also queue any number of files for sequential printing.

Indicate changes in your files with the Edit Marking function. It places a character in the margin column of your choice for each altered line. You can remove or retain markers from prior edits.

The Library, Append, and related indexing features help with cut and paste and forms operations. You assign any upper- or lowercase letter a control character, word, or group of words up to 2,000 characters long by using the Library command.

While inserting, hit Cancel and the single letter for the program to write your library phrase. Speed up editing by assigning single keys to print commands for underlining, boldface, and so on as part of the library.

Unfortunately, you can't review the library contents from the program. You should assign letters mnemonically related to the main idea to refresh your memory. For example, use U for underline, B for boldface, A for acknowledge-

ment, and H for header. Using this shortcut for more than a few phrases necessitates maintaining a printed master list of the library.

At any time you can Append a document from a storage unit on any drive. You can piece portions of text together by judiciously using the Erase to end of file command.

You can accomplish fast deletion of other sections by marking the end of the section you want deleted with a special character, such as @, and instructing Benchmark to define the text you want deleted from the cursor position to that character.

Forms and Formats

To construct form letters or documents from a bank of standard provisions, create master indexed files by following a prescribed format and call-

*"You can build a file
of standard letters
for common
business situations. . ."*

ing the Index facility. Type the identification tag assigned to selected master file provisions, and Benchmark assembles your completed document.

Although you can scan the whole collection of standardized provisions on the screen by going to the master file, a looseleaf reference book is more efficient.

Arrange your forms with fill-in variables, then Quick Search with one key to each variable in sequence. Using View and interactive printing, you run through the form each time you need it.

This leaves the original in the file with bracketed generic variables for future use. You can build a file of standard letters for common business situations that you can personalize at printout.

A more sophisticated forms feature sets up an information file with just the variables. Index this file, combine it with a form, and you automatically substitute all variables with one stroke.

For example, assemble the boilerplate waiver of notice of a corporate meeting with fill-in variables such as date and company. Enter date, place, company, officers' names, and all the

other variables in your data information file and index it. Use the index procedures to join the two files, press the Q key, and your minutes are complete.

Initial steps for indexing are difficult, so effective use of this feature takes practice. It's a powerful tool when you prepare similar documentation for a number of clients.

At an additional cost, Benchmark has a mail list option that merges a list of names and addresses with form letters. Benchmark lets you manually insert variables such as names, addresses, and other specific data into a number of the same form letters.

Preparing the master form, referred to as a pattern document, follows the same rules for variables entry as indexing. The Merge command generates form letters by responding to prompts for names and other fill-in variables.

You can print the letters as you go along, save them to disk, or both. Saving to disk first lets you review for errors or insert comments before printing.

With Merge, you must answer each variable prompt even if you repeat the same variable. Merge is handy for typical customer response letters sent out a few at a time as opposed to bulk mailing.

Benchmark has extensive formatting capabilities. You can center pages between margins or headings, or center titles on a line.

Top, bottom, right, and left margins are individually adjustable. Benchmark accommodates line widths of up to 155 characters. The program retains margins as part of the file and sets them automatically for your next edit.

By using the interplay between lines per inch and single- and double-spaced lines, you can produce the spacing you need. The amount of blank space at the end of ragged lines, right justification with whole spaces, and hyphenation are controllable. If you use single-sheet feeders, you can cue up to three trays by using software commands.

Automatic widow/orphan control settings assure that a minimum number of paragraph lines begin or end a page. You demarcate any group of lines that must remain on the same page or any word grouping that you want printed on the same line.

Besides superscript, subscript, underlining, boldface, and overstrike, singly and in combination, Benchmark pro-

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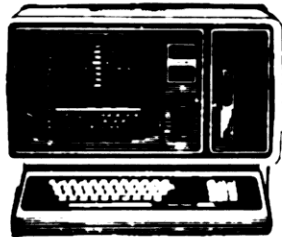
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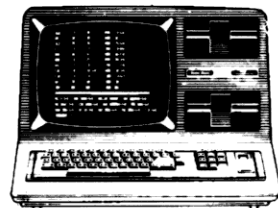
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✓ 116

vides shadow printing (double strike with the second impression slightly to the right of the first) and stop print for change of fonts or ribbons.

You insert a caret at the beginning and ending limits for print changes, but you must call another screen to determine the type of special print change involved.

Benchmark has several choices in tabs: regular, indent for outlining or inserting quotations, numeric for lining up decimals, centering for column headings, dot and underline for creating tables of contents, and right-justified to line up paragraph numbers in contractual documents or page numbers in tables of contents.

Business Graphics is an ingenious utility for drawing rectangular boxes to emphasize enclosed text. Actually, you can print text mixed with any line configuration you build from thin vertical and horizontal lines at 90-degree angles.

Constructing this takes a considerable amount of time and patience, and therefore might be of limited practical use, but the function shows what clever programming can do with a daisy-wheel printer and ordinary characters.

A real boon is the well-implemented Calculator. You can enter a list of bills, expense reimbursements, or costs and quantities needing extensions in a letter, voucher, or statement, and calculate the figures without ever leaving Benchmark. Addition, subtraction, multiplication, division, subtotals, and totals are available in horizontal and vertical directions.

Accumulated totals and subtotals are in real time at the bottom of the screen and you can write them anywhere in your text. Enhance Calculator with column formatting that permits insertion, deletion, transposition, and spacing changes of columns of figures. This is quite a versatile package.

Benchmark claims to support proportional printing for the more popular Diablo, Qume, or NEC daisy-wheel printers listed in the documentation, but it didn't work with my Qume Sprint 5.

Daisy wheels for most Diablo and Qumes use a different sequence for proportional wheels than regular fonts. Proportional printing wasn't possible and Metasoft couldn't find anyone who could explain or correct the problem.

My other disappointment was the inoperable special print option for Spanish diacritical marks, the accent and

tilde. Benchmark instructs you to use the grave accent to implement this feature, but the grave is the one character that you can't access from the keyboard. You can use overstrike procedures to produce diacritical marks provided they are on your print wheel.

Documentation

The manual's opening section on start-up information apparently changes for each major version of the software. It's not up to the quality of the remainder of the manual and would benefit from screen reproductions or reference to the manual sections that cover the same information.

A short introduction on computer use is followed by an overview of essential procedures, a reiteration of CP/M information, and the initial steps in running the word processor.

"... Benchmark is quality software that you should consider if you need a high level of sophistication and flexibility in your word processing."

The next 10 chapters each tackles a separate essential program aspect. With the exception of the section on tabs, descriptions are straightforward and explicit, though they lack sufficient examples. The manual should describe what happens when you hit the wrong key and indicate which commands are sensitive to case of letters.

The central portion of the documentation contains excellent reproductions of program screens. It includes a detailed table of contents, and a fair-sized index, immediately preceded by two pages listing brief descriptions for all commands and a page of system error codes. Other program error messages tend to be cryptic and need further explanation.

Considering the complexity of Benchmark, I feel that the index is sparse and needs expansion. Neither proportional printing nor foreign language features are in the index though they appear in the table of contents. However, the manual's organization is logical and helps

compensate for the skimpiness of the index references.

The remaining 16 chapters that describe advanced techniques are adequate. A cardboard quick-reference command sheet helps you avoid jumping to the help screen. The last section of the manual consists of command sheets describing key assignments and similar information for approximately 30 different terminals.

Overall, the tutorial and reference aspects are well done. Metasoft's planned revisions should bring the documentation up to the level the software deserves.

Criticism

With my 8-inch floppy system, loading and saving files and jumping to pages in documents move slowly if the text is more than a few pages long. Presumably a hard disk would improve this facet of performance.

When you save to disk and want to continue with the edit, you must reload initial menus. It seems like an eternity until you get back to the end of a long file. Until you save the file, any power glitch or fatal error in processing wipes out memory and all current edit changes.

Most file transfer programs using modems require ASCII. Additionally, you can quickly skim any ASCII format file from CP/M with Type without entering your word processor. Benchmark files require time and disk space to convert to ASCII before this type of processing.

To examine headers, footers, embedded print style changes (underline, bold-face), and line spacing, you must call a secondary display. Also, Benchmark's full space justification doesn't produce as professional looking documents as partial microspace justification.

Few micro word processors presently incorporate full software spooling, and Benchmark isn't one of them. If your word processing is continuous, you might want to consider a hardware solution.

As indicated by the four-star rating, I consider Benchmark one of the better micro word processing packages. It needs some improvements and has some drawbacks, particularly in speed of certain operations. However, Benchmark is quality software that you should seriously consider if you need a high level of sophistication and flexibility in your word processing. ■

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REVIEWS

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**Finger Print
Epson Printer Adapter
Dresselhaus Computer Products
837 East Alosta Ave.
Glendora, CA 91740
\$59.95**

by Alan Neibauer

Finger Print, an inexpensive hardware modification for Epson printers (with or without Grafrax), controls all print functions from the printer's panel switches.

For word processing systems that don't allow user print codes, and for all other data processing work, Finger Print makes it easy to select a full range of available fonts: double strike, emphasized, compressed, double width, and any combination of these.

While the modification does not replace embedded print codes in word processing, it has many useful features for both the writer and programmer, and is a valuable but inexpensive investment.

In addition to switching between fonts, Finger Print provides for perforation skipover, eight or six lines per inch, and has a selectable six-space indentation. The panel switches used to select these options still perform the normal functions of line and form feed.

At first, I was hesitant about opening up my Epson and installing Finger Print. However, the instructions are easy to understand and include photographs that illustrate each step.

Finger Print is supplied on a small circuit board with three integrated circuits and two leads attached. Remove one integrated circuit from the Epson and plug the Finger Print board into its location.

Number of Beeps	Function
1	Reset
2	Compressed
3	Double width
4	Emphasized
5	Double strike
6	Perforation Skip
7	Indentation (six spaces)
8	Eight lines per inch
9	Italic
10	Fine Print

Table 11. Number of beeps necessary to select Finger Print functions.

Before you insert the original Epson chip into a spot on the Finger Print board, you must bend one pin out at a 90-degree angle. Attach one of the leads with an easy to insert terminal to the bent pin.

Clip the other lead, complete with a spring hook, to a pin on another circuit. The entire modification takes only 15 minutes.

Using Finger Print

It took about the same length of time to understand how the modification works. Pressing specific patterns on the printer's panel switches gives you Epson fonts and functions.

You invoke Finger Print by holding down the on line button until a beep sounds. The beep means that Finger Print is ready to accept commands.

Select a particular function by holding the on line button until a series of beeps sounds. Pressing the form feed button activates the function and pressing line feed returns control to the printer (see Table 11).

For example, if you want a listing in emphasized type, you press the on line button until four beeps sound, press the FF (form feed) button to activate the font, and the LF (line feed) button to pass control back to the printer.

Activate several options at once by combining button sequences. Two beeps turn on compressed print, while five activate double strike. Press the on line button until two beeps sound, press the FF button, then hold the on line button until you hear five beeps, press the FF and LL buttons, and the printer produces double-strike compressed type.

Finger Print leaves the double width function on even after line feeds. Instead of returning to standard size after each line, double width printing stays in effect until you reset the function.

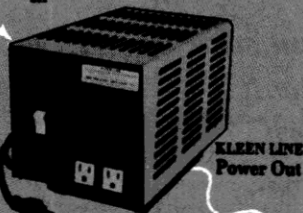
Features like italic and fine print type are only available on Grafrax models.

Since I do a great deal of programming, I appreciate Finger Print's perforation skipover abilities. After I turn the function on, it automatically leaves a 1-inch margin, neatly skipping perforations. I even use the indentation feature to make room for three-ring binding of my listings.

I am as pleased with the performance of Finger Print as I am with its ease of installation. ■

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The Reader's Guide to Microcomputer Books
Michael Nicita and Ronald Petrusha
Golden-Lee Book
1000 Dean St.
Brooklyn, NY 11238
Softcover, 410 pp.
\$9.95

by Eric Grevstad
80 Micro staff

Michael Nicita and Ronald Petrusha have reason to be proud. They've read over 400 of the computer books flooding the market, assessed each one's strengths and weaknesses, and compiled a helpful, perceptive guide for readers ranging from novice micro shoppers to MC68000 Assembly-language programmers.

They're sometimes more pleased with themselves for being cute than for their good work, but that detracts only slightly from this guide's value.

"While the 100-point scale is a handy shortcut, the guide's merit rests in the reviews."

The Reader's Guide to Microcomputer Books rates books on six topics: computer introductions, CPUs, operating systems and hardware design, programming, software and applications, and specific micro systems. The latter sections are subdivided to let you, for instance, find books on Basic or Pascal rather than hunt through all language entries.

VisiCalc and word processing get separate mention in the software category, and TRS-80, Apple, IBM, Atari, Commodore, and Timex owners can turn to their sections of the systems chapter.

The guide's format is laudably complete. In addition to a short review, Nicita and Petrusha give each book a

numerical rating from 10 to 100 (awarding 100s to only four books, including David Lien's *The Basic Handbook* and Lewis Rosenfelder's *Basic Faster and Better & Other Mysteries*).

Besides title, author, publisher, and price, each entry lists page count, size, and ISBN number—everything a book-seller needs to order the volume you desire. The guide includes indexes by title, author, subject, and rating, and even suggested stock lists for owners of small, medium, and large bookstores.

While the 100-point scale is a handy shortcut, the guide's merit rests in the reviews. As they're limited to a few paragraphs, Nicita and Petrusha sometimes bounce back and forth abruptly, praising a book's good points and then adding reservations about its flaws.

This flip-flopping in the name of fairness is most disturbing in reviews of books that fall in the middle range of their scale (roughly between 60 and 80 points).

But their assessment of each book's

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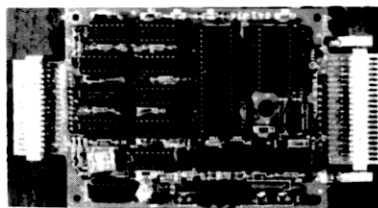
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best audience, whether elementary computer students or S-100 interface architects, is excellent, and their knowledge—or at least the range of topics on which they're willing to express opinions—is encyclopedic.

The reviewers praise Thomas Whiteside's *Computer Capers*, a 1978 book about mainframe embezzling schemes, and general-audience works such as Tracy Kidder's *The Soul of a New Machine*, as well as more technical entries.

Thomas Crowley's *Understanding Computers* (1967) is "an almost archaeological curiosity," to be "avoided for its technological obsolescence," but at the same time is "a rare window into an earlier generation of computer technology."

Also, Nicita and Petrusa are concise and witty writers. They say of an otherwise respectable work, "*CP/M Simplified* is at times CP/M disorganized." Dismissing *Dune* author Frank Herbert's *Without Me You're Nothing*, they quip, "We can only hope that [this

"...the authors...clearly relish every opportunity to lash bad books with smart remarks."

book] is not the beginning of a new tetralogy."

Herbert's not the only author who draws their scorn by trying to cash in on computers without caring about books' quality. T.G. Lewis' *How to Profit from Your Personal Computer*, the reviewers say, should be titled *How to Profit from Writing About Personal Computers by Including the Word "Profit" in the Title*.

This is fun, but it grows a little tiring. "We make no apologies for the sometimes acerbic opinions expressed in this first edition," the authors boast in their introduction, and they clearly relish every opportunity to lash bad books with smart remarks.

Explaining their rating system, they say that a score of 90-100 means "excellent," 80-90 "superior," and 10-40 "the best thing about these books may be the reviews."

But, if you can tolerate the authors' vanity, the *Reader's Guide* is a valuable reference work. No one will ever be in the market for every book reviewed here—there are 29 specific TRS-80 books, plus Z80- and language-oriented works that Tandy owners might use—but someone could conceivably use this book to decide which introduction to computers to buy, then what software guides to buy after getting a micro, and finally the best books to help in advanced programming and hardware practice.

The average micro owner, *Computerworld* says, will buy eight books as well as peripherals and software. If you're a beginner, the *Reader's Guide* deserves to be your first. If you're a veteran, it might deserve a place as your ninth. ■

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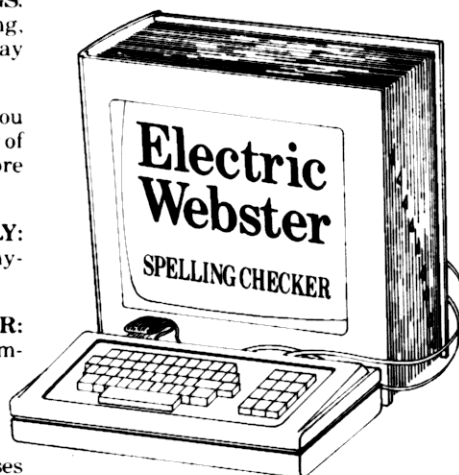
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Kwikdraw
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Model III, one disk drive
48K, TRSDOS 1.3

by Thomas L. Quindry

Draw and Kwikdraw are screen editing programs that let even novice users create and simultaneously display both graphics and text on either a screen display or an Epson MX-80 printer (except the MX-80 with Grafrax Plus). While both are good programs, Kwikdraw is written in machine language and is faster and more versatile than Draw.

Each program comes on a data disk. While you need only one disk drive to use either program, you need two disk drives to transfer the programs to a TRSDOS disk.

You can easily combine text and graphics in either Basic or machine-language programs. Draw offers adequate but minimal drawing capabilities; Kwik-

draw offers two or three times the versatility and much greater speed.

Draw

Draw provides 20 commands. You use the arrow keys and numeric keys 1-9 to position the cursor. The numeric keys locate the cursor at positions relative to the key's location on the keyboard; for instance, the 5 key positions the cursor at center screen.

The arrow keys display information according to how three display keys are set. The V key generates a conventional display of white on black, the I key displays inverse video, and the N key allows the cursor to move across the screen without affecting the display.

Draw's most useful command is for circle drawing. It produces circles of almost any diameter and obviates the tedium of trying to draw circles freehand.

Draw's fill command is another useful feature. It fills in areas of the display in either black on white or white on black. Switch between these two modes with the Reverse Screen command.

To draw diagonal lines, you have to specify the beginning and end points. Other commands let you draw horizontal or vertical lines to the screen edge or the nearest intersection of the same specified color.

You can also specify the character mode to add text to your display. In the

character mode, it's fairly easy to enter commands and return to the graphic mode.

The @ key acts as a control key for commands. You can also enter all the available Model III special characters by special command.

You can load your display into an ASCII disk file to save it for later retrieval. You can read this file from your Basic program, and so transport your art work to another program. You can also insert a display into machine language programs, but that's beyond the scope of Draw's instruction manual.

With Draw, you can overlay any saved file over an existing display. By creating modular shapes and patterns in different files, you can overlay them for a more interesting effect. You can always undo the display if you've saved the original.

If you want a printout of your display, you have a printer selection of TRS-80 mode or MX-80 mode. Draw uses the TRS-80 graphic capabilities of the MX-80 printers.

The mode you select depends on your printer's interior switch settings. You can set the Epson switches to either mode. Epson's TRS-80 mode recognizes the graphics character codes in your TRS-80 manual.

The MX-80 mode recognizes the graphics character codes as having a

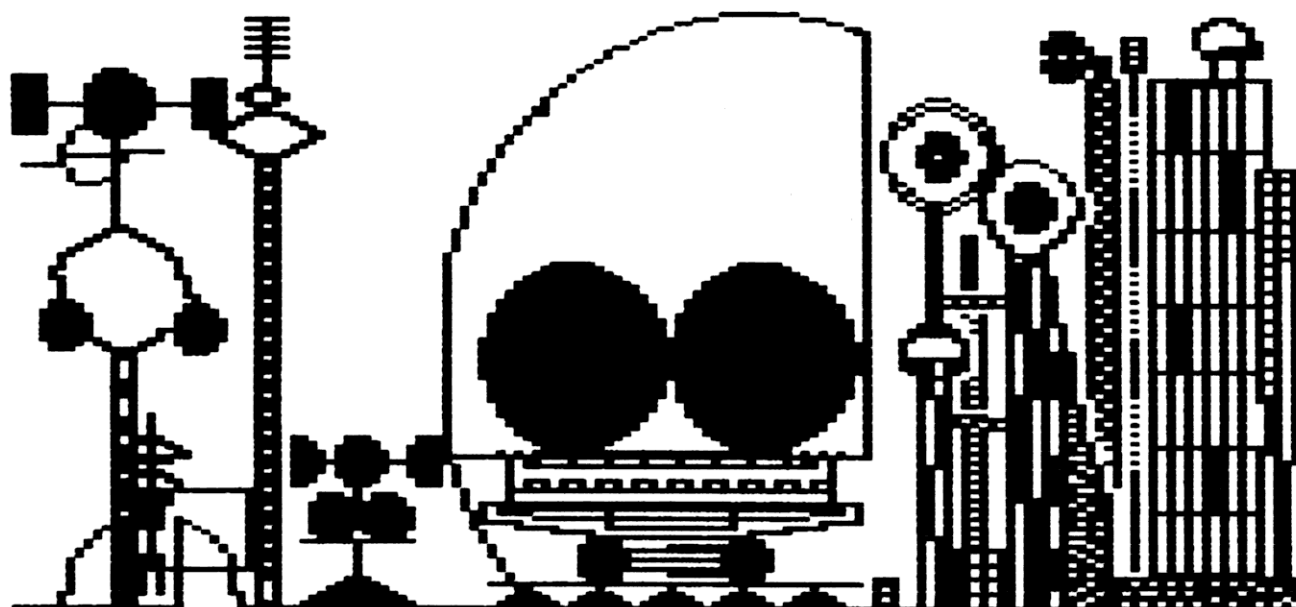


Figure 2. Space city mural is three screen displays drawn sideways and printed continuously.

value of 32 higher than the TRS-80 graphic characters. You get the Epson's most useful mode if you use software and switch selection to choose MX-80 mode.

When you give the command to line print the display, Draw's current printer default settings appear. The printer mode you're using determines the available settings.

You can change the settings for condensed character, normal, or double mode, and for emphasized or double-strike. The double mode is actually 66 characters per inch (cpi) rather than 40 cpi. The condensed printing mode has a printout display that closely approximates the video screen display.

Now you can choose to start the printout flush left, centered, or flush right. A good error-checking routine tells you when you can't use a printer setting.

Unfortunately, you can't set the MX-80 or TRS-80 mode at this time. You must make that selection at the earlier stage of the program.

You'll probably need to read Draw's 21-page manual only once. It explains the commands adequately, and the program is user friendly.

While creating your graphics display, you can return to the menu at any time to call up files that give you helpful information. One such file provides all the ASCII codes and indicates what appears on the screen if you use the special character command.

You can draw circles or change the printer mode only from the menu. After you finish using the menu, Draw restores your graphics screen.

A program listing in the manual shows how to use your displays in a Basic program. I don't know why this listing isn't on the disk as a user convenience.

In addition to the seven files that comprise Draw, the disk contains 10 sample display files and a display file that illustrates the fill routine.

The greatest inconvenience in programming with Draw is that you must protect high memory. You must remember what value to set since no remark statement in the program indicates that value.

I've corrected this in my copy by adding the following line to Draw, then saving the modified program:

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Draw works very well, and meets the needs of the casual programmer. It's painfully slow, but it provides an alternative to a more expensive graphic and text editor program.

Kwikdraw

Kwikdraw is faster, more powerful, and more expensive than Draw. Drawing a large circle takes only a few seconds with Kwikdraw; Draw needs one to two minutes for the same task. Kwikdraw includes all Draw's functions, and many more sophisticated capabilities.

One useful command moves one figure, text, or the entire display to another location on the screen. For example, you can move a cloud from the left side of the screen to the right side without altering the rest of the display.

The wraparound feature lets you put half of the cloud on each side of the screen. Another option moves the outline of an object and leaves its contents intact at the original location. You can also duplicate an object and leave the original in place.

One command shifts the whole screen right, left, up, or down. With this command, you can reposition a symmetrical pattern for different graphic effects.

You can save Kwikdraw displays in two ways: to a disk file or to memory buffers. You can save up to 10 displays in memory. Kwikdraw will overlay any of these displays or one from a disk file on the current screen display. With Kwikdraw's settings, you determine which part of the overlay dominates when the display characters or graphics conflict.

The Juxtapose routine places any buffer displays over the screen display, but not permanently. The buffer you select for juxtaposing flashes over the display.

You can use this feature to copy part of the display from the buffer to your screen display manually or to see how the combination might look. I find it useful to juxtapose a buffer to see what it contains before I save my current screen display to it.

One feature of Kwikdraw reverses the image of your display around a horizontal or vertical axis. I'd like a command that provides a mirror image of the left side of the screen on the right side without eliminating the left side. Then you'd get some great symmetrical or kaleidoscopic designs.

"Kwikdraw offers much more control than Draw."

Line printer control is better with Kwikdraw than with Draw. You can print specified buffers on the screen display. Printing any of the buffers is a

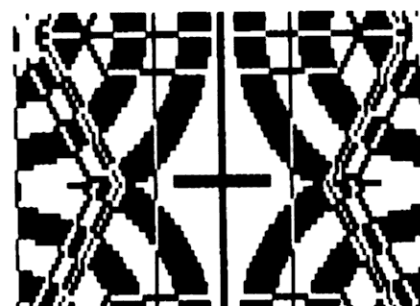


Figure 3. Window command shifts symmetrical display for different effects.

background operation. You select which buffers you want printed, then return to the screen display or perform any other function while printing resumes.

You can even change the contents of the buffers you've selected for printout. After a buffer has been printed, you can fill it with another display and reselect

the buffer for printing. You can do all this before the current printing operation is complete.

Kwikdraw has three file saving options. In addition to an ASCII file, you can save the display as a Basic subroutine file or an object code file. The three files load back into the Kwikdraw program without conversion.

You can merge the Basic subroutine with your Basic program and call it. The ASCII file is called from Basic in much the same way as in Draw. The object code file is placed anywhere in memory for later use by your Basic or machine language program.

The manual gives examples of each type of file. Four examples are on the disk as demonstration programs. You can easily incorporate these demonstration files into your program to save typing and eliminate keying in errors.

Kwikdraw offers much more control than Draw. As in Draw, you display programming information on the screen to give you the command codes available or the current settings for the controls.

If you don't like the default settings in Kwikdraw, you can change them and save your own file with the specified settings in it. You do the same for printer settings.

The manual for Kwikdraw is 54 pages and full of information. Kwikdraw is very user friendly, so you'll probably read its manual only once also.

I find no major faults with Draw or Kwikdraw. Some idiosyncracies do exist. Using Draw for circles that don't reside entirely on the screen can produce some unexpected results.

Using the routine to move a figure outline without moving its contents sometimes causes problems. Also moving a figure that extends to the edge of the screen doesn't always work. After you experiment, you'll learn what to expect and how to avoid any surprises.

If you expect to use graphics displays only on a limited basis, Draw is a good bargain. If you plan to use extensive graphics displays, spend the extra money for Kwikdraw. Both are good programs and will serve you well.

Nearly any display you create with Kwikdraw you can also create with Draw. It just takes longer with Draw and requires more ingenuity to accomplish the same results. ■

REVIEW DIGEST

Radio Shack Model 4, Tandy/Radio Shack, One Tandy Center, Fort Worth, TX 76102, \$1,999.

"...the Model 4 is a very powerful, flexible computer system. It can be used equally as well in a home as in a place of business. Either way, it is well worth the...price." *Interface Age*, September, p. 79.

The Official Silicon Valley Guy Handbook, Patty Bell and Doug Myrland, Avon Books, New York, NY, 105 pp., \$3.95.

"...the authors have managed to produce a gentle and surprisingly sensitive spoof of the stereotypical computer *wunderkind* lurking about laboratories and back rooms...: average-looking, bespectacled, his pale-blue polyester trousers a trifle too short, a wrinkled corduroy jacket (tan, of course), and a plastic pocket protector abulge with writing implements. And an ID badge. And a clip-on tie. And a beeper on his belt.

"...About the only people who won't appreciate it are in-house systems analysts, programmers, field engineers..." *Personal Computing*, September, p. 164.

CoCo-Cooler, Rem Industries Inc., 9420 "B" Lurline Ave., Chatsworth, CA 91311, Color Computer, \$39.95.

"...Thank goodness for CoCo-Cooler, a cooling fan from Rem Industries.

"...If you use your Color Computer for serious functions such as word processing, programming, or setting high game scores, you should invest in a CoCo-Cooler. The rea-

sonable price of \$39.95 may save you from your next system crash..." *Creative Computing*, September, p. 64.

The Computer Camp Book, Yellow Springs Computer Camp Inc., Yellow Springs, OH, 227 pp., \$12.95.

"...There's no quarrel with the information in this book.... Even educators and planners interested in establishing an extracurricular activity could gain a wealth of ideas and insight from *The Computer Camp Book*.

"...Sounds like a fine book, doesn't it? It is, if one stops at content and organization and has no interest in the quality of the physical product. ...the overall design suggests a cheapness unworthy of the book." *Personal Computing*, September, p. 167.

Martian Patrol, Melbourne House, Dept. CS 347 Reedwood Drive, Nashville, TN 37217, Models I and III, 32K, \$19.95 disk, \$15.95 cassette.

"You man a sophisticated land rover that just happens to be well armed and highly maneuverable.

"...The object of *Martian Patrol* is to explore various sections of the planet surface. ...As you bounce along the surface you must avoid large craters, outcroppings of rocks, and land mines. ...Combine all of these hazards with concentrated air attacks from enemy ships, and you have one heck of a game." *Creative Computing*, September, p. 161.

Thesaurus and Thesaurus Builder, Refware, POB 451, Chappaqua, NY 10514, Models I and III, \$89.95 and \$149.95.

"...is Refware's Thesaurus genuinely practical?... I don't think so.

"...Some TRS-80 owners will enjoy the novelty...while others will howl about the price—more than 10 times the cost of a Roget paper-back." *Popular Computing*, September, p. 197.

Moptown, The Learning Company, Follett Library Book Company, 4506 Northwest Highway, Crystal Lake, IL 60014, Color Computer, 16K Extended Color Basic, \$45 disk, \$40 cassette.

"...The Moptown program is a series of eleven learning activities, each designed to be progressively more difficult. Students from ages six to thirteen will have a challenging experience working through the Moptown activities.

"...As the activities progress, the students must learn to identify differences and patterns, and develop strategies to solve more complex problems." *The Color Computer Magazine*, September, p. 115.

Penguin, Displayed Video, 111 Marshall St., Litchfield, MI 49252, Models I and III, 48K, \$19.95 disk, \$15.95 cassette.

"The graphics in *Penguin* are cute, and the gameplay is light-hearted, but the sound effects are definitely lacking in intensity and complexity. ...Penguin is still a quality game that deserves a place in any software library." *Creative Computing*, September, p. 158.



The **PRODUCER**

The Professional Program Writer.

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What has your computer done for you lately? You bought it to be a powerful and time saving tool. But if lack of good software keeps you frustrated and makes your computer an expensive and idle gadget, The PRODUCER is here to solve your problem.

Now you can design and produce professional quality programs that meet your exact specifications and you don't even need to understand programming at all.

THE PRODUCER IS A SOFTWARE PACKAGE THAT WRITES PROGRAMS FOR YOU.

Even though you have no knowledge about how to write programs, you can now create impressive, sophisticated and functional software to manage your data. You answer simple English questions, draw your screen on your monitor exactly like you want it, and The PRODUCER writes the entire BASIC program by itself.

THE PRODUCER WAS DESIGNED FOR MICRO COMPUTER OWNERS WHO CAN'T FIND THE SOFTWARE PROGRAM TO DO WHAT THEY WANT IT TO DO.

You may never need to buy another computer program to store and retrieve information, perform calculations on your data and get displayed and printed reports. The PRODUCER can create customized software of truly professional quality.

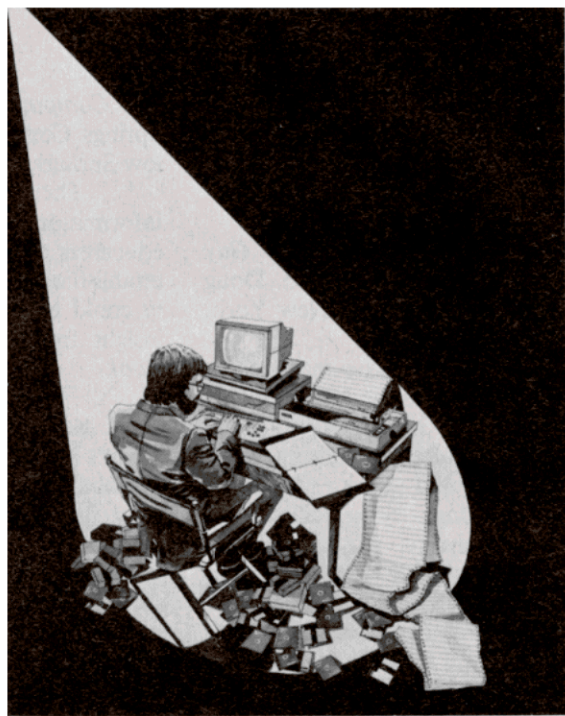
The PRODUCER makes the micro computer a useful tool to the novice and saves many hours of programming time for the experienced computer professional.

IF YOU ARE A NOVICE

The PRODUCER can make you feel like a pro. The Basic code is written for you. You push buttons, answer questions and watch the program develop in this remarkable process.

IF YOU ARE A PROFESSIONAL PROGRAMMER

The PRODUCER can be the time-saver you need to increase your productivity and make your job easier. The PRODUCER provides many of the advanced features found on products that cost many thousands of dollars more. You'll be proud to show your clients the professional quality programs created by The PRODUCER.



Listen to what one of our users wrote recently:

The PRODUCER has proven to be the greatest. I used to spend 70% of my time writing programs to create, maintain, sort, and list data. No More. Days and weeks of programming are now reduced to minutes and hours. The PRODUCER has increased the productivity of my custom software firm by 400%. This product is in a class reserved for the best.

A. Copelle, Northbrook, Illinois.

HOW DO I LEARN TO USE THE PRODUCER

In each TRS-80 version, we have provided a systematic guided tour of The PRODUCER program generator process. For the Model I and III, an audio cassette tape tutorial is part of your package. One of your fellow PRODUCER owners talks to you as you go through the step-by-step lessons. The tapes not only teach you the operating process, they enable you to actually create a program of your own design while you learn.

We have provided over 200 pages of thorough documentation in The PRODUCER Reference Manual, but we encourage you not to read the manual until after you have completed the tutorial. We've had many rave reviews from our users, like this one from S.R. Foster of Pensacola, Florida:

The tutorial was an excellent starter. It enabled me to get on with it without days and days of reading. Very helpful.

WHAT DO YOU GET WITH THE PRODUCER?

You will be impressed with the professionalism of the PRODUCER package:

DISKETTE(s) containing PRODUCER Program Development System.

REFERENCE MANUAL of over 200 pages of extensive, easy to read, well organized material. Attractive hardback 3-ring binder. Color keyed index tabs separate the chapters. Comprehensive alphabetical Index refers to specific chapter subsections.

QUICK REFERENCE CARD

REGISTRATION CARD

TUTORIAL SESSION including audio cassettes and detailed follow-along outline, written and produced by fellow PRODUCER user.

FREE HOME INVENTORY MANAGEMENT PROGRAM (\$59.95 value as a sample) allowing you to use a finished program immediately.

ONE YEAR SUBSCRIPTION to the PRODUCER newsletter

TOLL FREE NUMBER for technical assistance, available only to registered PRODUCER owners.



Pictured are the components of the Model III version of The PRODUCER. Other versions may vary slightly.



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HOW THE PRODUCER WORKS

We think you will be impressed with the ease of operation and the amazing versatility of features you get with the PRODUCER. Here is a step by step overview of the program writing process. The screen shown is an unretouched photo of the Master Menu from which each of these steps is selected.

☐ Planning Your Program

The PRODUCER provides a helpful planning form you can print on your own printer. It helps you organize your thoughts to create a tailor made program to meet your needs.

☐ Creating The Screen

Visible on your monitor will be the screen where information will be entered, edited and displayed. There are six simple steps to follow in creating your screen.

1. Draw Your Screen

Using the arrow keys construct the screen in any configuration you desire. With single keystrokes, enter large graphic letters and borders. Edit at will until you are satisfied.

2. Define Message Areas

Select an area of your screen where The PRODUCER messages to you will appear.

3. Define Input Fields

The PRODUCER will ask you questions about the areas where you will enter the data. You specify the length of each area or field, as well as acceptable characters in each field.

4. Define Display Fields

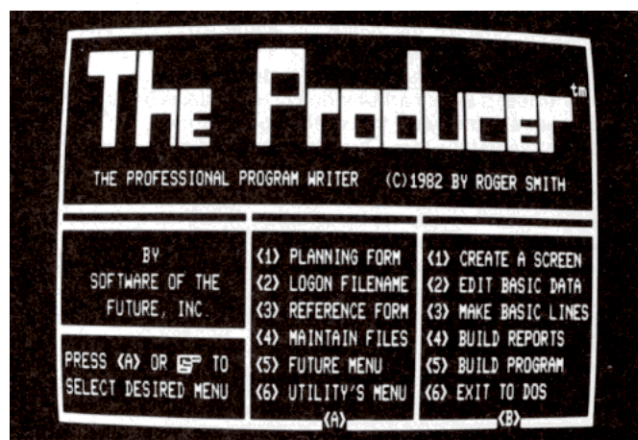
Locate the display fields anywhere you want on your screen. These show the results of the calculations you want made on your data.

5. Define Custom Prompts

You select an area where help messages to yourself can be displayed.

6. Save Your Results

Assign a working name for your program and save it to disk.



☐ Editing Basic Data

1. Edit any part of The PRODUCER program you have created -- screen field names, lengths, prompt areas, etc.
2. Type in any help message you want as a custom prompt to help you operate the program.
3. Easily create calculations for your program using actual field names. You can use the contents of any numeric field and all math operations including logical operators.

☐ Making Basic Code

Press a key, sit back and watch The PRODUCER do all the work of creating BASIC code for your program. You can see the program lines appear on your screen. Complete error checking is done for you.

☐ Building Reports

Virtually any report is available to you thru our NEW free form report generator. It works with any size paper. You are allowed up to 100 calculations within the report. You can specify exact position of any text information to any position on your paper (even preprinted forms, checks, etc.). An amazingly versatile tool.

☐ Building The Program

Put the finishing touches on your program by selecting cursor type, size, flashing speed, auto messages, custom logos, etc. After your selections have been made, press a key and your entire finished program is created in less than 5 minutes. That's all there is to this remarkably simple program generation process.

Continued

TECHNICAL INFORMATION

The PRODUCER provides many advanced features which allow you to do "magic" with the programs you create.

The SCREEN GENERATOR

- *Use the full screen (all lines and column positions)
- *Create a professional well organized screen with graphics
- *Save up to 9 separate screens in memory at one time and get instant access to each
- *Move the cursor to any location on the screen
- *Replicate bars/lines/graphics to define certain screen areas
- *Access an instantly available Help Menu of all Screen Editor commands
- *Insert and delete any character with a single keystroke
- *Clear or erase selected areas of any screen
- *Insert and delete whole lines on the screen
- *Center any text on the screen
- *Move any rectangular block of text anywhere on the screen (block move)
- *Create titles with a single keystroke large graphic letter alphabet
- *Move portions of screens between different screens (cut and paste)
- *Save any number of screens to disk at any time
- *Recall any screen from disk any time
- *Create BASIC lines to re-create any screen

FILE and RECORD HANDLING

- *Rapidly access records with BTREE File structure
- *Search for a record with only the first few letters of the name or key (partial key) (Example: locate PRODUCER by typing PR)
- *Recall and edit duplicate and multiple keys (Example: Several last names may be the same on a file and you can find and edit them individually)
- *Fully edit any part of a previously entered record
- *Recover unused space automatically upon deletion of a record
- *Enter data very fast with the special batch mode
- *Recall immediately any record after it's been entered, eliminating time consuming sorting and indexing
- *Rapidly access any record anytime (2-4 seconds average)
- *Globally search and replace data in certain fields in selected record range
- *Automatically rebuild any file to meet new specifications. No need to re-enter data when a file needs to be restructured.
- *Balance any BTREE file automatically to reorganize and speed up file access time
- *Recover from power failure and easily rebuild files that have been damaged. Avoid laborious re-entry of long data files

SCREEN ORIENTED INPUT and EDITING of DATA

- *Insert and delete characters at any position in any field. No "back to start" retyping of data
- *Move forward or back to previously entered fields to edit using the arrow keys. Totally non-destructive cursor. Does not require re-entering of each data field
- *Move within any field using the arrow keys
- *Move instantly to any field with Control G command
- *Exit from input/edit mode at any point allowing immediate escape from data entry mode. Allows partial information to be entered for each record without the annoying, time consuming need to press ENTER for each blank field not used at the time of entry
- *Duplicate field information from a previous record with one keystroke. No need to re-enter duplicate information, addresses, etc. on consecutive records
- *View a custom prompt, your own custom reminder or help message for each field with 1 keystroke
- *Verify each character typed automatically
- *Enter data as fast as you want, even if you are a speed typist
- *View visible display of automatic field length restrictions
- *View prompts for each field showing number of characters allowed

PRINTED REPORTS

- *Create up to 9 separate reports at a time in a finished program
- *Generate any number of reports you want (no limit)
- *Select reports by name from a report menu in the program
- *Select from six different automatic report formats including custom mailing labels
- *Instantly print reports by key with no time consuming sort necessary
- *Sort and print any other (non key) field with the fast machine language sort
- *Sort only records that meet your search criteria
- *Sort on more than one field if desired
- *Use any restrictions or search criteria to determine which records will be included in a report
- *Use any number of multiple search criteria (including logical) (Example: You can search for all the males who are single, and drive a car that are over 24 years old but less than 35 years old)
- *Send any special command to your printer before or after any report
- *Specify any line length needed and any page length desired
- *Select single line or multiple lines per record, even one page per record
- *Total any fields during the report (running totals)

FREEFORM REPORT GENERATOR

- *Specify column and row of every heading and field
- *Allow up to 100 of interfield calculations, even string calculations
- *Include any text anywhere on the screen
- *Keep sub-totals on any field and print at any time in any format
- *Format any numeric fields anyway you wish
- *Print reports on pre-printed forms, checks, etc.
- *Create form letters with merged field data, with no word processing necessary
- *Put any field anywhere on the page. No limitations

ADVANCED CALCULATIONS

- *Globally recalculate any field in any or all records. (Example: If file is a list of gold assets and the spot price changes, each separate asset may be recalculated with a new value for the spot price)
- *Use all math operations including exponentiation and trigonometry
- *Use logical calculations such as And, Or, Not, etc.
- *Use any level of parenthesis in calculation formulas
- *Save results in any field and display results in any field
- *Store temporary results in several extra memory slots
- *Pass calculation results between records
- *Determine the exact order of calculations
- *Display or save results at your option in the finished record

OTHER ADVANCED FEATURES

- *Edit any part of any program without starting over or redefining the entire program
- *Create screen and input modules only (for professional programmers)
- *Create Calculate-only programs with the easy desk-top super calculator program
- *Design custom logos for your program
- *Control cursor type, size, flash speed, etc.
- *Design custom prompts or help info for any field

YOU ALSO GET

- *FREE 1 year SUBSCRIPTION to PRODUCER Newsletter
- *TOLL FREE assistance number for all registered users
- *REFERENCE MANUAL of over 200 pages
- *FREE audio TUTORIAL

WHAT ARE PRODUCER USERS SAYING?

We continue to receive testimonials from satisfied users almost every day. Here's a sampling of the feedback we are receiving:

VALUE

VERY impressive! No matter how much I use the PRODUCER, there is no doubt I got my money's worth. It is clear the program, packaging and tutorial are developed with lots of thought....Very user friendly! Congratulations!

R. N. Forbes, Los Altos Hills, California

The PRODUCER package I received was excellent. The finest software package I have ever purchased. Far beyond my expectations.

S. R. Foster, Pensacola, Florida

I think the PRODUCER will save me so much time that it will give me the time to do the more important tasks that my business calls for and the money I'll save from not having to buy canned programs that are overpriced. Now with the PRODUCER I can write a program overnight to do almost anything I want it to do and with written reports to boot. Talk about saving time and money. I feel the PRODUCER will pay for itself with my first three programs.

S. Tornatore, Canastota, New York

The PRODUCER is a very impressive software package. It is well worth the money. While other micro owners are printing mailing labels, I am now selling them programs to use. I now have more time to spend enjoying my computer.

V. E. Ryberg, Bloomington, Illinois

I'm in love with the PRODUCER. It's one of my favorite programs.

R. Selsback, Burlingame, California

It was very complete and professionally done. The packaging and program seem to have been thought out before assembly and sale. The 'value' of the deal, everything included was the best I've seen to date.

G. Slusher, Martin, Kentucky

Very professional packaging. It gave the feeling of getting your money's worth before even running the program....Very easy to use and leaves very few questions unanswered....As you can see, I like the PRODUCER and was impressed with how trouble free it is.

A. C. Vincent, Napa, California

Excellent. Above and beyond other software.

R. Haggood, Henrietta, Texas

VERSATILITY

The PRODUCER is the best all purpose program generator I have used. (We have tried almost all of them.) The generated code is bug free, well commented and efficient.

R. A. Copella, Northbrook, Illinois

I bought the PRODUCER to save time. I feel capable of being able to write almost all programs I need. The PRODUCER generated programs will save a lot of time writing basic code and debugging. Using the PRODUCER I can write a good database type program using math calculation in about three hours. I don't have to tell you how long it would take writing the same program from scratch.

S. Tornatore, Canastota, New York

A special thanks to Roger and all of you. You've made my computing life easier and better. My 10 year old can't wait to get his hands on the PRODUCER.

J. D. Konkler, Columbus, Ohio

DOCUMENTATION

The Reference Manual is a work of art. Not only is it attractive and easy to use, it is so well organized, documented and logically written that the manual is a rarity in the software market place.

S. R. Foster, Pensacola, Florida

One of the best I've seen. We write about 20 volumes of material per year. Take it from a 'pro', it's good!

J. Crespi, Sherman Oaks, California

The PRODUCER Reference Manual is professionally written to provide ready access to easily understood answers to questions which arise during use of the PRODUCER.

R. A. Copella, Northbrook, Illinois

The Reference Manual is supreme and superior to anything I have worked with.

R. A. Neuman, Okemos, Michigan

Very well laid out and organized. One of the best I've seen.

J. D. Konkler, Columbus, Ohio

QUALITY

Thank you for an excellent program. I agree that The PRODUCER will change the entire concept of program creation in the future. But for now, you stand as the best data-base-management-system I can buy.

E. Sung, Vancouver, B.C.

Your system really is Software of the Future. Your staff has insight others of us only dream of. Congratulations on a product of extraordinary design.

S. R. Foster, Pensacola, Florida

This is an excellent program. At this point I am totally pleased. This is by far my number one software and I will use it anywhere and everywhere I possibly can both personal and business. Once again congratulations to all of the people involved.

R. A. Neuman, Okemos, Michigan

Comparison shopping indicates the PRODUCER's superiority to all others. And I already own most of the others.

R. A. Copella, Northbrook, Illinois

Glad to see you take an interest in what some of us hackers are up against. I think the PRODUCER will make the software hackers upgrade their products to this high level quality of the PRODUCER. I'm sure you realize that there is a lot of garbage on the market.

D. J. Smith, Lombard, Illinois

I was impressed by the professional appearance of your program. Other software I have received were on copy paper and stapled into a booklet with very vague instructions.

W. J. Mahaffey, Absecon, N. J.

USE

The program is almost idiot proof.

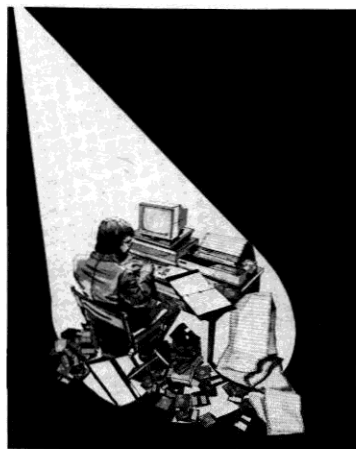
J. Crespi, Sherman Oaks, California

It is a very friendly friend and we will be working together for some time to come.

R. A. Neuman, Okemos, Michigan

Very easy to use and leaves very few questions unanswered.

A. C. Vincent, Napa, California



The PRODUCER

MODEL I version \$149.95

MODEL III version \$149.95

Available FALL/83 for

MODEL II \$299.95

MODEL IV \$199.95

MODEL 12 \$299.95

MODEL 16 \$299.95

MODEL 16 XENIX \$499.95

IBM - PC \$299.95

PRODUCER SOFTWARE

Box 1245
Arlington, Texas
76004-1245

Texas 817-274-6998

800-433-5355

Hello Bar Codes, Goodbye Keyboard?

by Hermes S. Mendez



Human error. That's what can make the keyboard, the most common means of entering data into a computer, inefficient. That's also why industries whose business requires a great deal of data input have encouraged other, more consistently accurate, means of data entry.

Optical scanning represents such a means. In optical scanning, the computer reads data directly, bypassing the keyboard and the possibility of human error. One method of optical scanning that currently enjoys widespread implementation and is expected to have a bright future is bar code technology.

Bar codes are graphical representations of binary coded data in the form

Through bar code technology you can input data faster and more efficiently than by keyboard.

of black and white spaces. The data can comprise anything adaptable to binary encoding—inventory numbers, prices, product identification, and so on. A laser

reads the bar code, translating and transferring the information to a computer in a virtually error-free environment.

A Brief History

Before getting into the basics of bar code technology, you should first take a look at its history. I checked the patents granted to bar code technology and found that in 1949, the U.S. Patent Office issued a patent for circular bar codes. By 1960, it patented the Rail Identification Symbol by Sylvania. Following this code was a proliferation of different bar code techniques.

By 1970 an ad hoc committee for U.S. supermarkets brought about the Universal Product Code (UPC)—the



COMPUTER-PERIPHERAL SWITCHERS

Connect any number of peripherals to a single I/O port — use a single printer to support several microcomputers — use two or more printers to support a single microcomputer — access a modem from any of several microcomputers — Ideal for reconfiguring or expanding equipment. The Selecto-Switches are designed to eliminate the unnecessary plugging & unplugging of cables which connect printers, terminals, or modems to various computers. By using a Selecto-Switch, you achieve more efficient system operation, better utilization of peripherals & computer ports, eliminate redundant hardware & reduce service calls. 5 yr. limited warranty on all Selecto-Switches. No power required. Size (inches): 10L x 7W x 3H. 2lb. 10oz.

RS232 SERIAL SELECTO-SWITCH

- Switches all lines of asynchronous data • Easy expansion of serial ports • Connectors are female DB25 type

PART NO.	DESCRIPTION	PRICE
GRS232-AB	2-Way Switch	\$139.95
GRS232-ABC	3-Way Switch	\$179.95

DB25 PARALLEL SELECTO-SWITCH

- TRS-80, Apple, and IBM compatible • Switches 24 lines (line 1 is ground) • Connectors are female DB25 type

PART NO.	DESCRIPTION	PRICE
GP24-AB	2-Way Switch	\$139.95
GP24-ABC	3-Way Switch	\$179.95

CENTRONICS-STYLE SELECTO-SWITCH

- Switches all 36 lines • Connectors are female Centronics

PART NO.	DESCRIPTION	PRICE
GCENT-AB	2-Way Switch	\$199.95
GCENT-ABC	3-Way Switch	\$229.95

Micro-Logic Corp. MICRO-CHARTS

- Fully decoded data • Instant access • 2-sided, totally comprehensive • Compact 8 1/2 x 11 in. durable credit card plastic • Perfect for programmers & engineers • Clear & concise tables for: full instruction set, disassembly, ASCII, base conversion, effect of flags, compare vs. jump, interrupt structure, pinout, cycle times, diagrams, bug notes, & much more...

PART NO.	REFERENCE	PRICE
ML-Z80	Z80 CPU	\$5.95
ML-8080A	8080A/8085A	\$5.95
ML-6502	6502 (65XX)	\$5.95
ML-8048	8048, Relatives	\$5.95
ML-7400	5400/7400 TTL Pin-Outs	\$5.95

BOOKS

30001	National CMOS Data Book (1981) (640 pages) 74AC, CD4000, and A/D Converters	\$6.95
30003	National Linear Data Book (1982) (1376 pages) LM, LF, ADC, DAC, LH Series	\$11.95
30006	National Memory Data Book (1980) (464 pages) RAMs, ROMs, PROMs, EPROMs Series	\$6.95
30009	Intersil Data Book (1983) (1356 pages) Complete line.	\$9.95
30010	National Audio/Radio Handbook (1980) (240 pages) Pre-Amps, AM, FM & FM Stereo, Power Amps	\$5.95
30012	National PAL Data Book (1982) (176 pages) Application Notes, Linear Briefs, etc.	\$5.95
30013	Zilog Data Book (1983) (641 pages) Microprocessors and Support Chips	\$7.95
210830	Intel Memory Components Handbook (1983) (798 pages) Contains all Application Notes, Article Reprints, Data Sheets, and other design information on Intel's RAMs, EPROMs, E ² PROMs & Bubble Memories.	\$14.95
210844	Intel Microprocessor & Peripheral Handbook (1983) (1027 pages) Contains Data Sheets on all of Intel's Microprocessors and Peripherals.	\$14.95

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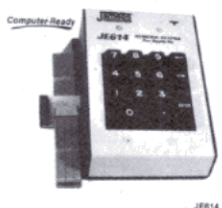
Jameco	Digital Thermometer Kit Dual sensors — switch controls for indoor/outdoor or dual monitoring — can be extended to 500 feet. Continuous LED 8" ht. display. Range: 40°F to 199°F, 40°C to 100°C. Accuracy ±1° nominal. Calibrate for Fahrenheit/Celsius. Simulated walnut case. AC wall adapter included. Size: 6 1/2" x 3 1/4" x 1 1/2".	\$39.95
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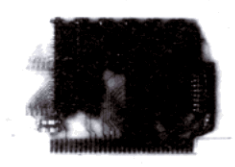
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676V, 680V, 684V, 688V, 692V, 696V, 700V, 704V, 708V, 712V, 716V, 720V, 724V, 728V, 732V, 736V, 740V, 744V, 748V, 752V, 756V, 760V, 764V, 768V, 772V, 776V, 780V, 784V, 788V, 792V, 796V, 800V, 804V, 808V, 812V, 816V, 820V, 824V, 828V, 832V, 836V, 840V, 844V, 848V, 852V, 856V, 860V, 864V, 868V, 872V, 876V, 880V, 884V, 888V, 892V, 896V, 900V, 904V, 908V, 912V, 916V, 920V, 924V, 928V, 932V, 936V, 940V, 944V, 948V, 952V, 956V, 960V, 964V, 968V, 972V, 976V, 980V, 984V, 988V, 992V, 996V, 1000V, 1004V, 1008V, 1012V, 1016V, 1020V, 1024V, 1028V, 1032V, 1036V, 1040V, 1044V, 1048V, 1052V, 1056V, 1060V, 1064V, 1068V, 1072V, 1076V, 1080V, 1084V, 1088V, 1092V, 1096V, 1100V, 1104V, 1108V, 1112V, 1116V, 1120V, 1124V, 1128V, 1132V, 1136V, 1140V, 1144V, 1148V, 1152V, 1156V, 1160V, 1164V, 1168V, 1172V, 1176V, 1180V, 1184V, 1188V, 1192V, 1196V, 1200V, 1204V, 1208V, 1212V, 1216V, 1220V, 1224V, 1228V, 1232V, 1236V, 1240V, 1244V, 1248V, 1252V, 1256V, 1260V, 1264V, 1268V, 1272V, 1276V, 1280V, 1284V, 1288V, 1292V, 1296V, 1300V, 1304V, 1308V, 1312V, 1316V, 1320V, 1324V, 1328V, 1332V, 1336V, 1340V, 1344V, 1348V, 1352V, 1356V, 1360V, 1364V, 1368V, 1372V, 1376V, 1380V, 1384V, 1388V, 1392V, 1396V, 1400V, 1404V, 1408V, 1412V, 1416V, 1420V, 1424V, 1428V, 1432V, 1436V, 1440V, 1444V, 1448V, 1452V, 1456V, 1460V, 1464V, 1468V, 1472V, 1476V, 1480V, 1484V, 1488V, 1492V, 1496V, 1500V, 1504V, 1508V, 1512V, 1516V, 1520V, 1524V, 1528V, 1532V, 1536V, 1540V, 1544V, 1548V, 1552V, 1556V, 1560V, 1564V, 1568V, 1572V, 1576V, 1580V, 1584V, 1588V, 1592V, 1596V, 1600V, 1604V, 1608V, 1612V, 1616V, 1620V, 1624V, 1628V, 1632V, 1636V, 1640V, 1644V, 1648V, 1652V, 1656V, 1660V, 1664V, 1668V, 1672V, 1676V, 1680V, 1684V, 1688V, 1692V, 1696V, 1700V, 1704V, 1708V, 1712V, 1716V, 1720V, 1724V, 1728V, 1732V, 1736V, 1740V, 1744V, 1748V, 1752V, 1756V, 1760V, 1764V, 1768V, 1772V, 1776V, 1780V, 1784V, 1788V, 1792V, 1796V, 1800V, 1804V, 1808V, 1812V, 1816V, 1820V, 1824V, 1828V, 1832V, 1836V, 1840V, 1844V, 1848V, 1852V, 1856V, 1860V, 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2436V, 2440V, 2444V, 2448V, 2452V, 2456V, 2460V, 2464V, 2468V, 2472V, 2476V, 2480V, 2484V, 2488V, 2492V, 2496V, 2500V, 2504V, 2508V, 2512V, 2516V, 2520V, 2524V, 2528V, 2532V, 2536V, 2540V, 2544V, 2548V, 2552V, 2556V, 2560V, 2564V, 2568V, 2572V, 2576V, 2580V, 2584V, 2588V, 2592V, 2596V, 2600V, 2604V, 2608V, 2612V, 2616V, 2620V, 2624V, 2628V, 2632V, 2636V, 2640V, 2644V, 2648V, 2652V, 2656V, 2660V, 2664V, 2668V, 2672V, 2676V, 2680V, 2684V, 2688V, 2692V, 2696V, 2700V, 2704V, 2708V, 2712V, 2716V, 2720V, 2724V, 2728V, 2732V, 2736V, 2740V, 2744V, 2748V, 2752V, 2756V, 2760V, 2764V, 2768V, 2772V, 2776V, 2780V, 2784V, 2788V, 2792V, 2796V, 2800V, 2804V, 2808V, 2812V, 2816V, 2820V, 2824V, 2828V, 2832V, 2836V, 2840V, 2844V, 2848V, 2852V, 2856V, 2860V, 2864V, 2868V, 2872V, 2876V, 2880V, 2884V, 2888V, 2892V, 2896V, 2900V, 2904V, 2908V, 2912V, 2916V, 2920V, 2924V, 2928V, 2932V, 2936V, 2940V, 2944V, 2948V, 2952V, 2956V, 2960V, 2964V, 2968V, 2972V, 2976V, 2980V, 2984V, 2988V, 2992V, 2996V, 3000V, 3004V, 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most widely known code due to its use in grocery stores. The UPC, formally adopted in the U.S. in 1973, was closely followed by a European version of the code in 1977.

The early 1980s brought wider acceptance of bar codes as the Defense Department adopted bar codes to keep track of supplies and equipment. Bar codes have grown to wide acceptance and use within such industries.

The general public became aware of bar codes only when grocery chains converted their checkout counters to automatically read bar code information. A laser beam, which crisscrosses on the food item, detects the bar code pattern, deciphers it, and accesses the computer's memory for specific information on the item.

By 1981, over 4,000 U.S. and Canadian supermarkets implemented the necessary scanning equipment.

Who Benefits?

Some of the obvious consumer benefits of grocery-store bar codes are:

- almost flawless entry of the price information;
- the name and price of the specific item on the cash register tape;

● less time standing in the checkout line (studies show a 42 percent average savings in time);

● the promise of lower cost due to savings in personnel needed at the store.

The most obvious vendor benefits include:

- keeping track of inventory and taking less store personnel time;
- checking the movement of each specific item to determine which are just "warming the bench";
- automatically ordering items needed from a central warehouse when a minimum is reached;
- controlling shoplifting by tracking the placement of items.

There are also benefits that apply equally to the consumer and the vendor. One is the electronic transfer of funds between accounts. At the checkout

counter this system debits your bank account for the total price of groceries and instantly credits the store's account by the same amount.

The railway system has also put bar codes to good use. By reading the horizontal bar codes on the side of the car, automatic laser scanners along the track of a station can detect what cars are on the line and their locations. This can also keep track of the contents of each specific car.

Many libraries around the nation are converting their card catalogs to computerized systems. Recently, I became familiar with this at the University of Central Florida and found it a great help in research work. Many of these same libraries use bar codes on the books to help increase the speed and efficiency of checking books in and out.

Even the health care industry has discovered how bar codes can increase the efficiency of the hospital as well as keep costs down due to loss of items or the failure to charge patients for goods used. The hospital issues each patient a bar code symbol at the time of admittance. With bar coded items, the hospital can easily charge the individual by running the scanner over the patient's

A bar code reader for the Model 100 was not available at press time. The topic will be covered in a future issue.—Eds.

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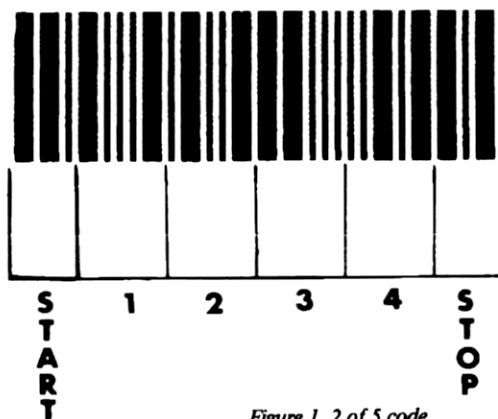
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189

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1234

Figure 1. 2 of 5 code.

code, the item's code, and the employee's code.

Another example of the health industry using bar codes is in keeping track of units of blood. Workers tag units with a bar code symbol that, when scanned, provides pertinent information as to blood type, source, and blood donor. This method uses the Codabar symbol. Health agencies nationwide use it to provide accurate and rapid processing of blood and related products. This code is also known as 3 of 9 Code.

Magazines and paperbacks sold in most stores already use UPC coding. Magazines add another portion to the

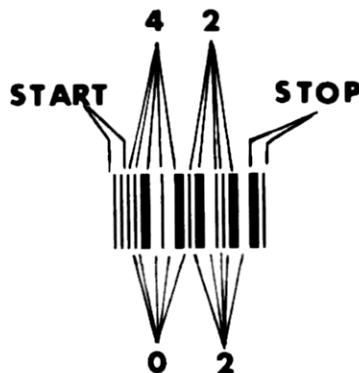


Figure 2. Interleaved 2 of 5 code.

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Date	Contribution	
2/05/83	\$225.00	Jones, R.
2/09/83	\$450.00	Billings, J.
2/11/83	\$1,500.00	Mares, P.
2/15/83	\$390.00	Davis, N.
2/19/83	\$2,000.00	Franks, B.
2/23/83	\$945.00	Howard, R.

ORIGINAL

Date	Contribution	
2/19/83	\$2,000.00	Franks, B.
2/11/83	\$1,500.00	Mares, P.
2/23/83	\$945.00	Howard, R.
2/09/83	\$450.00	Billings, J.
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code called the UPC Addendum which indicates the issue date. You can find this type of code on the cover of this magazine.

The military has adopted a bar code called LOGMARS (Logistics Applications of Automated Marketing and Reading Symbols). This method provides a standard for identifying all shipments to the Defense Department and promises to provide greater efficiency in the management of U.S. supplies and materials on a worldwide basis. The U.S. Armed Forces require all manufacturers providing goods to their branches to use the code.

Manufacturing in general greatly benefits from bar code techniques. For example, the Chevrolet Motor Division in Buffalo, NY, has used bar code labels on its axle assemblies since 1975. The scanner reads the label, sorts, and routes the axle assemblies to their proper locations. To identify 33 possible combinations of carburetors, distributors, and exhaust gas recirculation valves, the Pontiac Motor Division uses bar codes on its engine blocks. It identifies any mismatching in the assembly instantly.

Another example is the employees at the Research Center of Xerox Corporation in Webster, NY, who have bar codes on their I.D. cards. When supplies are distributed, an attendant scans the bar codes on the supplies and on the employee's I.D. card. The computer automatically bills the appropriate department for the supplies.

The list goes on and on. As you can tell, many bar code applications already exist and many more will come.

Why Bar Codes?

Basically, reading bar codes is fast and accurate. Keyboard entry ranges from one character per second (cps) to several cps, depending on the speed of the operator, the complexity of the data, and the environment. Keyboard entry in general is subject to many mistakes, estimated at one error for every few hundred keystrokes.

For example, Bell Telephone Laboratories reports that the uncorrected numeric keying errors in typing mailing addresses range from .42 to .48 percent of the total numeric keystrokes; that's about one error to every 208-230 characters typed. Other research finds lower accuracy.

Contrast this to industrial bar code reading, accurate to one error for every several million characters entered. Research, according to Datalogic, shows errors per 3 million entries to be: 10,000

using keyboard; 300 using OCR; one using Code 39 bar codes.

There are many types of bar codes in use, most evolving from specific applications and methods of interpretation. I'll briefly describe a few of the many different bar codes presently in use.

2 of 5 Code

This code originated in the late 1960s for use in warehouse systems. Companies also use it to identify envelopes as well as airline tickets. This is a very simple code in which the information depends on the width of the bars (see Fig. 1). The bars are either narrow or wide, the wide bars being three times the size of the narrow bars. The narrow bar is equivalent to a zero bit and the wide bar to a 1 bit. Spaces are equal to the width of the narrow bar but do not contain any information. For this reason, the 2 of 5 code is called a discrete code.

Interleaved 2 of 5 Code

This code is similar to 2 of 5 codes except that the spaces between the bars do contain information. Warehousing and heavy industry use this code widely (especially the automotive industry). Bars represent odd-numbered digits, and spaces represent even-numbered digits.

On the left, the start character consists of a narrow bar, narrow space, narrow bar, and narrow space. The stop character consists of a wide bar, narrow space, and narrow bar (see Fig. 2). It is a self-checking code since every character has a built-in check to avoid errors due to printing defects. It is continuous rather than discrete since there is information in the spaces. The width of the wide elements ranges from two to three times the narrow.

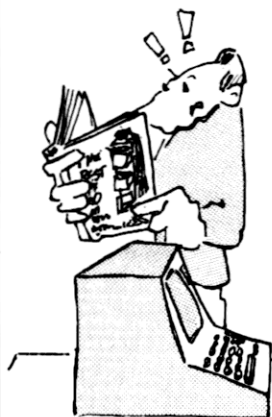
3 of 9 Code

The 3 of 9 code, also known as Code 39, provides for 44 data characters. Three of the nine elements are wide and the remaining six narrow. Each character consists of five bars and four spaces (nine total characters) in which two bars and one space are wide. Digits zero through nine are represented in the same way as in the 2 of 5 code. This code is also discrete and self-checking. This is a popular code with many applications, including the health industry. It's probably the most widely used bar code in industry and the Department of Defense.

Codabar Code

Libraries and the health field put Codabar codes to wide use. A variation of this code was one of the early con-

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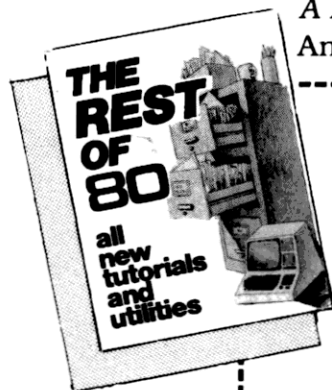
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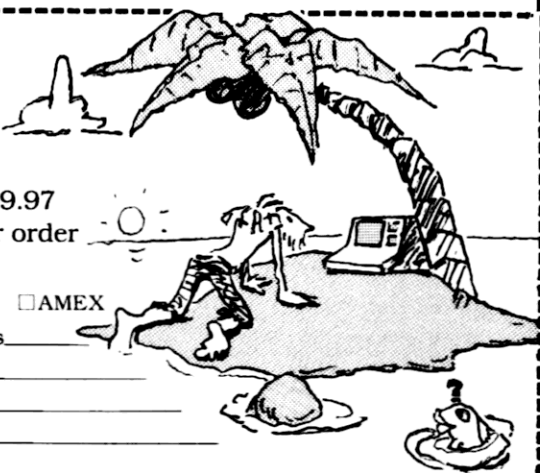
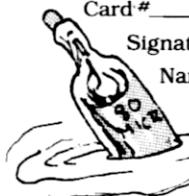
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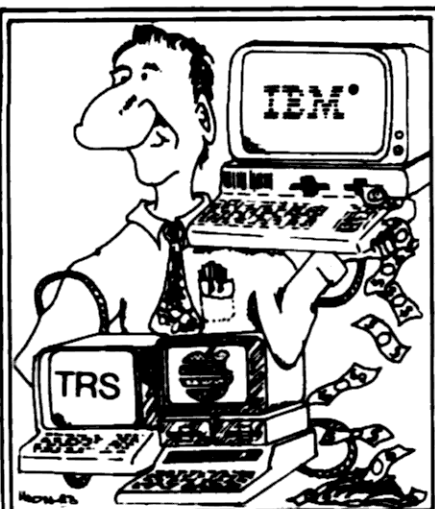
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tenders for the Universal Product Code. It is the standard for use on blood bags. Discrete and self-checking, Codabar codes consist of four bars with three spaces. The complete bar code symbol consists of a stop/start character, the data characters, and another stop/start character. Since it's a variable-length code, it is versatile but limited to 16 different characters—the 10 digits; the period, hyphen, and colon; and the plus, slash, and dollar signs.

Code 11

You can find Code 11 labels on telecommunications components and equipment. The code consists of 11 different data characters, 10 digits, and the dash symbol. Each character consists of three bars with two spaces. This code is discrete but not self-checking.

UPC/EAN Codes

After the U.S. adopted the UPC in 1973, the Europeans became interested and adopted the European Article Numbering (EAN) Code in 1976. The two are fully compatible. In fact, the UPC is a subset of the EAN.

The U.S. considered many factors in adopting the UPC, including ease of printing the codes on packages, quality of the print, and its omnidirectional scannability.

In the middle of the code two thin alignment bars project above and below the rest of the code, separating the right section from the left. You will find two similar bars at the beginning and end of the code.

A combination of seven bars and/or spaces make up the digits. The thin spaces represent a binary zero and the thin bars a binary 1. Multiple thin bars adjacent to each other appear as a wide dark bar.

The left half is coded differently from the right half. The left half identifies the manufacturer, and the right half identifies the specific item. Each half consists of six digits, with the last digit on the right half a check digit computed from the preceding 11 digits. Each character also contains a parity check giving this code a high level of error-checking. The character parity determines the scan direction instead of the start/stop character. In 1975 an addendum allowed magazines and periodicals to place information as to the specific issue number (see 80 Micro's UPC on the cover).

A number of codes exist that I won't cover here, including the Plessey Code, Ames Code, Nixdorf Code, and others. As applications grew many companies developed their own symbology, but the

basic properties are the same. A good bar code symbol should have as many of the following properties as possible:

- Self-checking
- Constant character width
- Structurally simple
- A large alphanumeric character set
- Constant number of bars
- Useful at variable scanning speeds
- Generous tolerance in printing the bar codes
- High density

Depending on the application, the potential user may trade off one property for another.

Reading Bar Codes

In order to read bar codes you need a fixed or portable scanner and a decoder—usually a hardware/software combination that converts the bar code into ASCII characters. A grocery checkout counter provides a good example of the fixed scanner, since the items move over the scanner itself and don't have to touch its surface. The portable scanner usually consists of a pen-like instrument, or wand, and related hardware.

These wands work on a simple principle. The scanner emits light which reflects back from the code to a photo sensor inside the wand. The voltage produced by the photosensor and related electronics is proportional to the code's pattern. The black regions absorb light and the light areas reflect it. Scanners come with a white or red light source. Portables use red more often because white light requires more power. Red light reads codes printed in all colors except red.

Two factors are critical to a successful scan. First, you need high contrast between the light and dark areas of the code. Contrast ratios of 80 to 90 percent greatly improve the efficiency of the whole system.

The second critical point is the widths of the code segments. Wide bars and spaces are two, two and a half, or three times the narrow bars. For a successful read, the decoding unit must be able to distinguish a narrow bar or space from a wide.

Once the code is read, your software determines how to handle the data. ■

Hermes S. Mendez teaches computer science at Forest Lake Academy. He can be reached at the school at 3909 East Semoran Road, Apopka, FL 32703.



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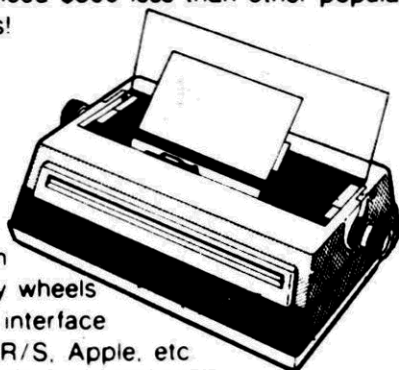
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MOD I/III

Bars and Stripes Forever

by Davey S. Thornton



Bar codes—they're fast, they're efficient, they're accurate, they're everywhere! Now you can print them on the Model III—here's how.

Most people think of bar codes as the striped labels on grocery items that identify a product and its cost. But bar code applications are more extensive—they are used in both industrial and commercial sales, inventory control, and equipment and product status accounting.

Several different types of bar codes exist. Grocery stores use the Universal Product Code (UPC); a description of

UPCs along with a program to produce them appears on page 114. This article explains how industrial bar codes work and provides a Model III program to generate the standard bar codes: Interleaved 2 of 5, 3 of 9, and Codabar bar codes.

How the Codes Work

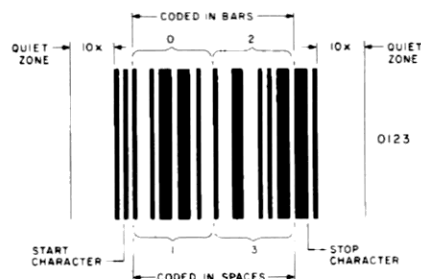
A bar code is a self-contained message that rapidly transmits data between

independent systems with relative security and minimal hardware. Since bar codes interface with computers, binary notation is the basis for the algorithms used to encode and decode data.

The Interleaved 2 of 5 code has a maximum of 2 of 5 bits as binary 1s (wide bar or wide space) in any code sequence. The Interleaved 2 of 5 code consists of a set of start and stop bits with a maximum of five groups of bars and spaces representing 10 numeric characters (see Fig. 1). A narrow bar or space represents a logic zero and a wide bar or space a logic 1. In each group of bars and spaces, the bars represent the first character and the spaces represent the second character. Figure 1 gives the code sequence for the Interleaved 2 of 5 code.

Interleaved 2 of 5 code represents only numeric characters while the 3 of 9 code represents both numeric and alphabetic characters. Each character in a 3 of 9 code consists of 9 bits with five bars and four spaces. The 3 of 9 code is so named because no more than 3 of 9 bits can be logic 1s (wide bar or wide space) in any one sequence. Further, the space between the characters is not significant because of the discrete nature of the code.

Interleaved 2 of 5



Data Character Set

Wide bars and spaces = Binary 1
Narrow bars and spaces = Binary 0
Each data character contains 5 binary elements,
2 of the 5 are binary 1s

Data Character	Weighted Position				
	1	2	4	7	P
0	0	0	1	1	0
1	1	0	0	0	1
2	0	1	0	0	1
3	1	1	0	0	0
4	0	0	1	0	1
5	1	0	1	0	0
6	0	1	1	0	0
7	0	0	0	1	1
8	1	0	0	1	0
9	0	1	0	1	0

Figure 1. Interleaved 2 of 5 code sequence.

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16. The TAB function will now tab 255 columns on a printer. (BASIC cannot tab past column 64.)
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18. NEW and EASIER to use USR COMMANDS.
19. New math functions to calculate XOR and INTEGER REMAINDERS of a DIVISION.
20. Logical STRING COMPARISONS are now supported.
21. The disk commands INSTR, MID\$, ASSIGNMENT are now supported on both DISK AND TAPE ZBASIC.
22. DEFSTR is now supported.
23. Eight disk files may be opened simultaneously; random, sequential or mixed.
24. LINE INPUT#, is now supported.
25. Invoke the compiler by simply hitting these two keys: ":-"
26. NEW 60+ PAGE MANUAL WITH DESCRIPTIONS AND EXAMPLE.
27. ZBASIC 2.2 Comes with CMDFILE/CMD program from MISOSYS, to allow appending or merging compiled programs and machine language programs from tape or disk.

ZBASIC 2.2 DOES NOT SUPPORT THESE BASIC COMMANDS:

1. ATN, EXP, COS, SIN, LOG, TAN, and exponentiation. (However, subroutines are included in the manual for these functions.)
2. ERROR, ON ERROR GOTO, ERL, ERR RESUME.
3. No direct commands like AUTO, EDIT, LIST, LLIST ETC, although these commands may be used when writing programs.
4. Others NOT supported: CDBL, CINT, CSNG, DEFFN, FIX, FRE.
5. Normal CASSETTE I/O. (ZBASIC supports it's own SPECIAL CASSETTE I/O statements.)
6. SOME BASIC COMMANDS MAY DIFFER IN ZBASIC. For instance, END jumps to DOS READY, STOP jumps to BASIC READY etc.
7. MEMORY REQUIREMENTS: to approximate the largest BASIC program that can be compiled in your machine (at one time), enter BASIC and type: PRINT (MEM-6500)/2. Remember, you can merge compiled programs together to fill memory.

ZBASIC 2.2 SPEED COMPARISON DEMO

To help give you an idea how fast compiled programs are, we have included this demo program:

ZBASIC 2.2 DEMO PROGRAM

Time to compile and run complete program : 0 MIN. 2 SEC.
BASIC Execution speed MOD I, LEVEL II : 7 MIN. 34 SEC.
ZBASIC Execution speed MOD I, LEVEL II : 0 MIN. 18 SEC.
BASIC Program size (WITHOUT VARIABLES) : 895 BYTES
ZBASIC Program size (WITHOUT VARIABLES) : 2733 BYTES

(Remember that the ZBASIC program includes an 1879 byte sub-routine package.) Program shown exactly as compiled and run in BASIC and ZBASIC.

```
10 '===== ZBASIC 2.2 EXAMPLE PROGRAM AND TIME TEST=====
20 CLS:CLERR:DEFINT A-X:DEFSTR Z:DIM AA(64,24),Z(50):RANDOM
30 AA=100:BB=-1000:CC=3:DD=-3:EE=-9999:ST$="START TIME "+TIME$
40 FOR I=1 TO 127 STEP 2 :FOR J=47 TO 1 STEP -3:XX=POINT(I,J):SET(I,J)
50 XX=(I-J)/CC*(7+I+J):XX=ABS(INT(RND(I*J)-AA)+7):RESET(I,J)
60 XX=PEEK(I+J):POKE15360+I+J,J:OUT255,J AND (3*J):XX=INP(I)
70 AB$=STR$(I+J):BA$=LEFT$(AB$,2):AA(I/2,J/2)=VAL(BA$)+AA*3
80 BA$=BA$+RIGHT$(BA$,RND(3)):XX=INSTR(1,BA$, "9"):XX=SQR(I*J)
90 BA$=MID$(BA$,2,2):MID$(BA$,1,1)=2:IF XX THEN 100 ELSE CLS
100 IF LEN(BA$)3 OR SGN(XX)=1 AND ASC(BA$)=32 THEN PRINT"+++"
110 IFPOS(0)62 THEN TRON:TROFF:PRINT ELSE XX=NOT(RND(99))+100
120 AB$=INKEY$:IF AB$="Y" OR AB$="y" AND I120 THEN PRINT"TRUE.."
130 RESTORE:READA,C,Z(J),D:GOSUB170:GOSUB170:GOSUB170:GOTO210
140 NEXT:PRINT" ":NEXTI:CLS:PRINT0512,ST$,"STOP TIME "+TIME$
150 STOP'===== END OF MAIN TEST LOOP =====
160 DATA 12345,-1,"TEST",-9999
170 ON RND(6) GOTO 180,190,200,180,190,200
180 RETURN
190 RETURN
200 RETURN
210 ON RND(9) GOSUB 180,190,200,180,190,200,180,190,200
220 GOTO140
```

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Char	Pattern	Bars	Spaces	Char	Pattern	Bars	Spaces
1		10001	0100	M		11000	0001
2		01001	0100	N		00101	0001
3		11000	0100	O		10100	0001
4		00101	0100	P		01100	0001
5		10100	0100	Q		00011	0001
6		01100	0100	R		10010	0001
7		00011	0100	S		00101	0001
8		10010	0100	T		00110	0001
9		01010	0100	U		10001	1000
0		00110	0100	V		01001	1000
A		10001	0010	W		11000	1000
B		01001	0010	X		00101	1000
C		11000	0010	Y		10100	1000
D		00101	0010	Z		01100	1000
E		10100	0010	-		00011	1000
F		01100	0010	*		10010	1000
G		00011	0010	SPACE		01010	1000
H		10010	0010	+		00110	1000
I		01010	0010	\$		00000	1110
J		00110	0010	/		00000	1101
K		10001	0001	+		00000	1011
L		01001	0001	%		00000	0111

Figure 2. 3 of 9 code sequence used as start/stop code only.

Number	7-bit code	Bar pattern	Character	7-bit code	Bar pattern
0	0000011		-	0001100	
1	0000110		\$	0011000	
2	0001001		:	1000101	
3	1100000		/	1010001	
4	0010010		.	1010100	
5	1000010		+	0010101	
6	0100001		a	0011010	
7	0100100		b	0101001	
8	0110000		c	0001011	
9	1001000		d	0001110	

Figure 3. Codabar code sequence. (Reprinted with permission from Bar Code News.)

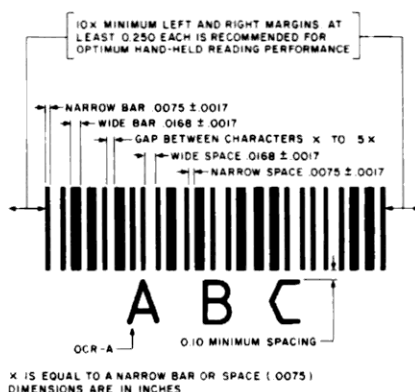


Figure 4. MIL-STD-1189 code dimensions.

The 3 of 9 code uses the spaces between bars to point to one of five character groups. Within the group, the bar identifies the specific character. These bar codes use the same binary sequence as the Interleaved 2 of 5 code (see Fig. 2). This pattern holds for all but four special characters represented by bars equal to logic zero and spaces with alternate three logic 1s. Figure 2 gives the code sequences for the 3 of 9 code.

Codabar code includes a numeric set, six special characters, and four interchangeable start/stop codes. Unlike the 2 of 5 and the 3 of 9 codes, you can scan Codabar codes in either direction. The

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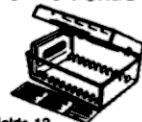
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	UPC/EAN	3 of 9 Code	Interleaved 2 of 5	Codabar
Character Set	Numeric	Alphanumeric plus - . * \$ / + % and space	Numeric	Numeric plus \$ - : / . +
Number of Characters Encoded	10	43	10	16
Start and Stop Codes	Unique, both (101)	Unique, both (*)	Start NB/NS/ NB/NS Stop WB/NS/ NB	4 possible a/t,b/n,c/*, d/e
Number of Module Combinations Used	4	2	2	2
Maximum Substitution Error Rate without Check Digit (CD)	CD required	1 in 10 ⁶	1 in 10 ⁶	1 in 10 ⁶
Maximum Substitution Error Rate with Check Digit (CD)	1 in 10 ⁶	1 in 10 ⁹	1 in 10 ⁶	1 in 10 ⁹
Ten-character Length for .010- Inch Module (Nominal)	.70 inch	1.4 inch	.90 inch	1.0 inch
Variable Length	No	Yes	May be w/CD	Yes
Discrete	No	Yes	No	Yes
Self-Checking	Yes	Yes	Yes	Yes
Date Introduced	1973	1974	1972	1972
Codified in Standards	UPCC/IAN	USD2&3/ANSI/ DOD/ALAG	USDI/ANSI/ ALAG	USD4/ANSI/ CCBBA
Market Influence	Retail	Industrial & Government	Industrial	Medical/Photo/ Libraries

Table 1. Comparisons of popular bar-code symbologies.

length of the Codabar character isn't fixed as in the 2 of 5 and 3 of 9 codes shown below.

0 through 9, -, \$ L1 = 5*X + 2*N*X
:, /, ., +, A, B, C, D L2 = 4*X + 3*N*X

The difference in L1 and L2 lengths shows up as (N-1)*X, but is not significant and can be made up in the inter-

character gap. Since the code is discrete, the intercharacter gap change doesn't affect code readability. Figure 3 gives the Codabar sequence.

Printing Code

Next, determine if you can use a specific dot-matrix printer as an inexpensive and convenient bar code printer.

Using MIL-STD-1189 (see Fig. 4) and the ANSI bar code specifications (see Table 2), you can determine the density of printable bar code characters, and whether a specific printer can print bar codes. However, the vast majority of dot-matrix printers with graphics capability are capable of printing bar codes of some density. (For a more rigorous evaluation of this subject, I recommend an article by Wellman Hoff in the winter issue of *Computer Technology Review, the System Integration Source Book*, West World Productions Inc. This article includes a Basic program for evaluating dot-matrix printers.)

Since my system includes an Epson MX-80 FT printer, my evaluation is limited to this printer. The MX-80 prints 120 columns per inch in the high-resolution mode. This equals a horizontal spacing of .00833 inches. The vertical spacing is restricted to the minimum

CODABAR CODE



* 1234567890-\$ *

INTERLEAVED 2 OF 5 CODE



* 1234567890 *

3 OF 9 CODE



* CODE TEST SEQUENCE *

Figure 5. Sample bar-code printout.

platen shift, which equals .00463 inches. The dot separation, .01388 inches, defines the dot diameter.

There are two relationships you must examine to determine if a specific printer is capable of printing a bar code.

The first is the overall ratio of narrow to wide elements. This depends heavily on the ratio of the dot diameter to the vertical and horizontal spacing. With the Epson MX-80 this difference is approximately 1.6-to-1 (.01388/.00833 = 1.666) and 3-to-1 (.01388/.00463 = 2.998) for the vertical spacing.

This amount of overlap also tells you that the second relationship—the dot gap between both vertical and horizontal dot placement is not significant because of the size of the dot diameter. With a dot radius equal to or greater than the separation between dot positions, there is little or no dot gap.

Thus, for the Epson printer, the dot over-print is the controlling factor and affects the narrow-to-wide element ratio. Table 3 gives a list of narrow- to wide-element dot-row widths and the density in characters per inch.

The Program Listing provided here produces 2 of 5, 3 of 9, and Codabar codes. The program asks for a code sequence and the input specifies the type of code you want produced. If you desire 3 of 9 code, you must use a sequence of up to 30 alphanumeric characters. (The 3 of 9 code has a restriction of 43 characters but the listing prints only 30 characters in compressed mode and 20 characters in standard mode.)

If you desire 2 of 5 code, then a period precedes the code sequence and you can use only numeric characters. With the 2 of 5 code, the sequence must be less than or equal to 10 characters.

If you want the Codabar code, then in addition to preceding the code sequence with a period, you must include a stop/start code after the period and before the code sequence. Since the Codabar start/stop codes are interchangeable, you can use a different code at either end. If you desire a different code at the end of the sequence, include it during the entry; otherwise, the program assumes that you want the code specified as a start code as a stop code.

Scanning the Code

To help those of you who are ready to jump up and write the definitive scanning routine, here are a few tips.

First, assuming that you use a TRS-80 Model III, you can make some assumptions about the speed of the

scanning algorithm and the problems you're likely to encounter. Assume that the algorithm takes 50 microseconds to execute, then estimate that the routine has a sampling rate of about 20,000 samples per second (sps).

If you wave the reading wand at the average rate of about 30 inches per second (ips), you find that each sampling period corresponds to a wand travel of about .0015 inches (30 ips/20,000 sps). As discussed earlier, the narrow-bar spacing is .01666 inches based on a dot row equal to two dot rows for a narrow bar or space. Thus, you can see that a narrow bar or space consists of approximately 10 samples—each representing

about 10 percent of the narrow-bar/space width.

This tells you that a read system, based on the TRS-80 Model III, is susceptible to errors in acceleration/deceleration and variable speed of wand motion. Incorrect readings used in calculations contribute to additional errors.

Bar code scanners have circular viewing areas or apertures (which vary from .0045 to .017 inches in diameter). This increases the chance for error since reflected light entering this aperture is converted from an analog signal to a binary digit. The scanner diameter adds additional error as a result of the amount of light admitted, and the size

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BAR CODE	ELEMENTS	ELEMENT WIDTH TOLERANCE T	WIDE-TO-NARROW ELEMENT RATIO N*
INTERLEAVED 2-OF-5	NARROW BAR W NARROW SPACE W WIDE BAR WIDE SPACE	$\pm \left(\frac{18N - 21}{80} \right) W$	2:1 TO 3:1 (MUST EXCEED 2.2:1 WHEN- EVER NARROW ELEMENT <0.02-IN. WIDE)
3-OF-9	SAME AS ABOVE	$\pm \frac{4}{27} (N - 2/3)W$	SAME AS ABOVE
CODABAR	9 BAR WIDTHS 10 SPACE WIDTHS	$\pm \frac{0.0015}{0.0065} \times \frac{\text{ELEMENT}}{\text{WIDTH}}$	DOES NOT APPLY

N = THE RATIO OF THE WIDTH OF THE WIDE ELEMENT TO THE WIDTH OF THE NARROW ELEMENT

(NOMINAL RATIO:N MUST BE HELD CONSTANT WITHIN AN INTERLEAVED 2 OF 5 AND 3 OF 9 BAR CODE SYMBOL.)

FOR ALL THE ABOVE BAR CODES:

BAR CODE HEIGHT MINIMUM IS 0.25 IN. FOR HAND SCANNING OR 15% OF THE BAR CODE LENGTH, WHICHEVER IS GREATER; MINIMUM OF 1.25 IN. OR 25% OF THE BAR CODE LENGTH, WHICHEVER IS GREATER, FOR TRANSPORT PACKAGES.

MINIMUM NOMINAL WIDTH OF NARROW ELEMENTS IS 0.0075 IN. EXCEPT FOR DIRECT PRINTING ON CORRUGATED CONTAINERS, WHERE 0.040 IN. IS REQUIRED.

VOIDS OR SPOTS MEETING EITHER OF THE FOLLOWING ARE PERMITTED:

- (1) CONTAINED WITHIN A CIRCLE WHOSE DIAMETER IS 0.4 TIMES THE NOMINAL WIDTH OF THE NARROW ELEMENT.
- (2) OCCUPIES NO MORE THAN 25% OF THE AREA OF A CIRCLE WHOSE DIAMETER IS 0.8 TIMES THE NOMINAL WIDTH OF THE NARROW ELEMENT.

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Table 2. Summary of ANSI bar code specifications. (Reprinted with permission from Computer Technology Review.)

of the bar/space reflecting that light.

The elements scanned are represented by two widths. The ratio of narrow-to-wide should be between 2-to-1 and 3-to-1. The algorithm should compare neighboring elements in consecutive fashion. Compare bars to bars and spaces to spaces. Comparing these elements to their nearest neighbor minimizes errors resulting from speed changes (acceleration/deceleration).

Use the start/stop code as a known to identify the start of a code sequence as well as to define the narrow and wide bar/space widths as determined by the

wandering rate. Use these values to evaluate successive code bits. All of these calculations can't be made during the scanning process without further reducing the scan rate, which is unacceptable. It is possible, however, to store the scan

data and perform the calculations after the stop code is received. ■

Contact Davey Thornton at 8128 Brucar Court, Gaithersburg, MD 20877.

Program Listing. Bar code print routine.

```

10 *****
20 *      BAR CODE PRINT ROUTINE      *
30 *      by                          *
40 *      Davey S. Thornton           *
50 *      8128 Brucar Court          *
60 *      Gaithersburg MD. 20877     *
70 *      Print Interleaved 2 of 5, 3 of 9 *
80 *      and Codabar codes          *
90 *****
100 CLEAR2000:DIM R(255),D$(59),E$(10),C$(33),A$(4)
110 FOR I=1 TO 59
120 *      LOAD BINARY CODE      ****
130 READ D$(I):NEXT I
140 DATA "011000100",,"010101000","000101010",,"010010100","0
10001010",,"010000101","110000100","010100010","000110100","100100
001","001100001","101100000","000110001","100110000"
150 DATA "001110000","000100101","100100100","001100100",,"010
0001001","001001001","101001000","000011001","100011000","00101100
0","000001101","100001100","001001100","000011100"
160 DATA "100000011","001000011","101000010","000010011","100010010
","001010010","000000011","100000110","001000110","000010110","110
000001","011000001","111000000","010010001","110010000"
170 DATA "011010000"
180 FOR I=1 TO 10:READ E$(I):NEXT I
190 DATA "00110","10001","01001","11000","00101","10100","01100","0
0011","10010","01010"
200 FOR I=1 TO 33:READ C$(I):NEXT I
210 DATA "0011000",,"0010101",,"0001100","1010100","1010001","

```

Listing continued

Dot Row Narrow Elements	Dot Row Wide Elements	Density in Characters/Inch
* 2	5	4.1379
** 2	7	2.8583
3	8	2.6667
4	9	2.1827
4	10	2.0698
4	11	1.9680

*Program Listing in standard mode.

**Program Listing in compressed mode.

Table 3. MX-80 FT printer evaluation.

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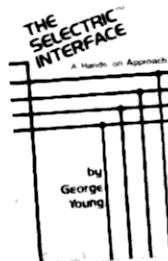
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WAX BOOKS

Listing continued

```
0000011","0000110","0001001","1100000","0010010","1000010","010000
1","0100100","0110000","1001000","1000101",,,,,,"0011010"
220 DATA"0101001","0001011","0001110"
230 FOR I=1 TO 4:READA$(I):NEXTI
240 DATA"0101100","1001010","1101000","0111000"
250 CLS:INPUT "ENTER 'L' FOR STANDARD FORMAT OR 'C' FOR COMPACT FO
RMAT":QS
260 IF QS="L" THEN C1=3:C2=4 ELSE IF QS="C" THEN C1=2:C2=3 ELSE G
OTO 250
270 CLS
280 'INPUT SEQUENCE *****
    " " "A,B,C,D" SEQUENCE "A,B,C,D" CODABAR
    " " SEQUENCE 2 OF 5 CODE
290 ' SEQUENCE 3 OF 9 CODE
    WHEN ENTERING CODABAR CODE THE STOP CODE MAY
    BE LEFT OFF IF THE SAME CODE WAS USED AS START CODE.
300 'EXAMPLE
    CODABAR .A1234567890-$/+D
    2 OF 5 .1234567890
    3 OF 9 ABC-XYZ1234567890.$/ +%
310 INPUT"ENTER CODE SEQUENCE":QS
320 IF LEFT$(QS,1)="." THEN 440 ELSE TS=""
330 '***** PRINT 3 OF 9 CODE *****
340 IF LEN(QS)>20 AND C1=3 OR LEN(QS)>30 AND C1=2 THEN PRINT"STRIN
G TO LONG REENTER":GOTO310
350 PRINT"3 OF 9 CODE"
360 LPRINT"3 OF 9 CODE":LPRINT
370 FOR I=1 TO LEN(QS)
380 TS=TS+D$(ASC(MID$(QS,I,1))-31)+"0":NEXT I
390 TS=D$(11)+"0"+TS+D$(11)
400 FOR I=1 TO LEN(TS)
410 R(I)=VAL(MID$(TS,I,1))
420 NEXT I
430 GOTO600
440 TS="":SS="":QS=RIGHT$(QS,LEN(QS)-1)
450 '***** PRINT 2 OF 5 CODE *****
460 IF ASC(QS)>=65 THEN 650
470 IF LEN(QS)>11 THEN PRINT"STRING TO LONG REENTER":GOTO310
480 PRINT "INTERLEAVED 2 OF 5"
490 LPRINT "INTERLEAVED 2 OF 5 CODE":LPRINT
500 FOR I=1 TO LEN(QS)-1 STEP2
510 TS=TS+E$(ASC(MID$(QS,I,1))-47): SS=SS+E$(ASC(MID$(QS,I+1,1))-
47)
520 NEXT I
530 SS=SS+" " :RS=""
540 FOR I=1 TO LEN(TS)
550 RS=RS+MID$(TS,I,1)+MID$(SS,I,1):NEXT I
560 RS="0000"+RS+"100"
570 FOR I=1 TO LEN(RS)
580 R(I)=VAL(MID$(RS,I,1)):NEXT I
590 TS=RS
600 N1=LEN(TS):K=0:N6=0
610 FOR I=1 TO LEN(TS):IFK=0 THENK=1ELSEK=0
620 N6=N6+R(I)*C2+C1:NEXT I
630 GOSUB 770
640 GOTO310
650 Q=ASC(QS):QS=RIGHT$(QS,LEN(QS)-1):TS=""
660 Q1=ASC(RIGHT$(QS,1)):IF Q1>=65 THEN QS=LEFT$(QS,LEN(QS)-1) ELS
E Q1=Q
670 '***** PRINT CODABAR CODE *****
680 IF LEN(QS)>17 THENPRINT"STRING TO LONG REENTER":GOTO310
690 PRINT "CODABAR CODE"
700 LPRINT"CODABAR CODE":LPRINT
710 FOR I=1 TO LEN(QS)
720 TS=TS+C$(ASC(MID$(QS,I,1))-35)+"0":NEXTI
730 TS=C$(Q-65)+TS+A$(Q1-65)
740 FOR I=1 TO LEN(TS)
750 R(I)=VAL(MID$(TS,I,1)):NEXTI
760 GOTO 600
770 '***** PRINT BAR CODES *****
780 FOR M=1 TO 8
790 LPRINT CHR$(27)"A"CHR$(4);
800 N4=FIX(N6/256)
810 LPRINT CHR$(27)"L"CHR$( (N6/256-N4)*256)CHR$(N4);
820 K=0
830 FOR J=1 TO N1
840 IF K=0 THEN K=1 ELSE K=0
850 FOR I=1 TO R(J)*C2+C1
860 LPRINT CHR$(127*K);
870 NEXT I
880 NEXT J
890 LPRINT
900 LPRINT CHR$(27)"e";
910 NEXT M
920 LPRINT CHR$(27)"e"
930 LPRINT CHR$(27)CHR$(14)** " QS" **
940 RETURN
950 END
```


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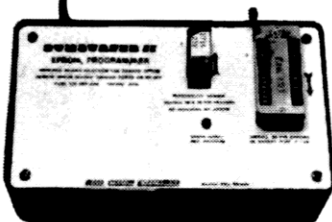
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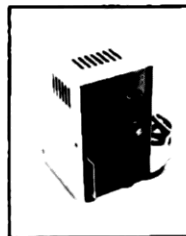
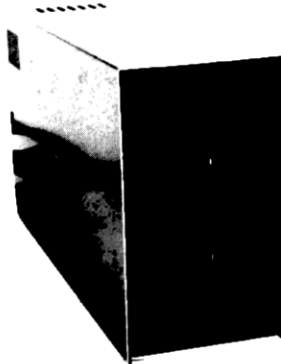
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Check-Out UPCs

by Davey S. Thornton



The Universal Product Code is probably the bar code you're most familiar with. Here's some of its history and a program that generates UPCs.

Just about everybody has seen bar codes, the most ubiquitous being the Universal Product Code (UPC) on grocery items. Their convenience is most obvious at the checkout counter, where a laser beam reads and not only rings up the item, but identifies it and adjusts the store's inventory accordingly.

The UPC seemed to come out of nowhere, but today it's commonplace. In this article I'll examine Universal Product Code technology and some of its

history, as well as provide the means to print the standard UPC-A code with a Model III and an Epson MX-80 printer with Grafrax (see Fig. 1).

UPC History

The idea for point-of-sale data capture by bar codes isn't much more than 15 years old. The roots of the UPC go back to the early 1970s when an ad hoc committee developed and standardized a point-of-sale data system. Initially the

committee felt that the system should provide the product name and price with a single action, thus reducing time required for product sales, improving system accuracy, and ultimately paying for the implementation cost through these savings.

The grocery industry formed the Uniform Grocery Product Code Council, comprising representatives of the grocery manufacturers and supermarket chains, to oversee the development of the UPC and to maintain code assignments. During code development, the Uniform Grocery Product Code Council established a subcommittee to oversee the development of a standard code. The subcommittee reviewed optical symbols, suggested changes, and reviewed study results. The guidelines it initially defined include:

- A successful first-read rate of 99 percent;
- A substitution rate of 1/10,000;
- A scan rate from 3 to 100 inches per second; and
- A code length of 10 characters (revised to 12).

From its initial development, the code was meant for use with fixed scanners. Later the subcommittee, in an effort to provide versatility, included

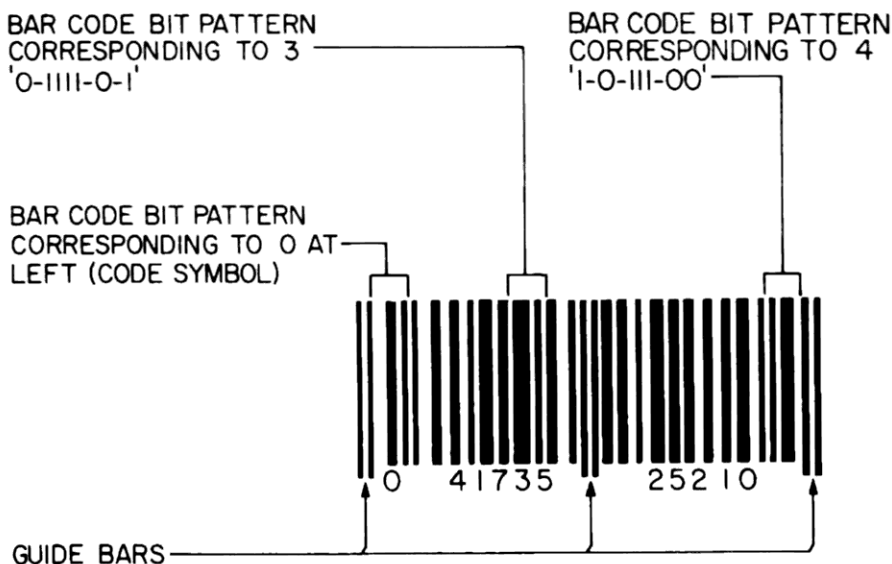


Figure 1. Standard UPC-A code.

The Key Box

Model I and III
32K RAM
Assembly Language
Editor/Assembler
Epson MX-80 with Grafrax

UPC

A	Regular
B	Drug B
C	12-character
D	12 + n character
E	Zero suppression

Character Format

SXXXXX-XXXXXC
SXXXXX-XXXXXX
XSXXXXX-XXXXXC
SXXXXX-XXXXXCXX...
XXXXXX

X = information character

S = code decimal character

C = modulo 10 check character

Table 1. UPC character specification.

requirements that would allow reading UPCs with a hand-held wand and the naked eye.

Code Design

Figure 1 is an example of the UPC found on grocery products. The UPC is classified as a multilevel code, which means that the code, appearing as multiple levels of bars and spaces, uses width modulation to encode data. Each bar or space represents one bit of binary data and corresponds to a level of encoding. The binary encoded data of the UPC has reflective spaces (blank areas) that represent logic zeros, and non-reflective bars (solid lines) representing logic 1s.

Because of the diversity of consumer product size and shape, users found that they must design more than one code to meet the needs of the whole industry. Table 1 gives the specifications of the five UPC codes developed. All versions, with the exception of E, use the number of the code symbol character to identify both the type of code and the type of item.

Self-Testing

The UPC has a self-test feature that assures an accurate read. It's found in all UPC codes except versions B and E. The self-check feature involves a value called the modulo 10 check digit. A modulo 10 check digit verifies correctly coded data. It does so through a series of calculations, the result of which must zero out; otherwise the read is unsuccessful and a new read is required.

The modulo 10 of a number is its remainder when divided by 10. For example, the modulo 10 of 16 is 6.

The equation used in determining the modulo 10 of a UPC is:

$$\text{modulo } 10(3X(\text{UPC symbol} + \text{UPC even digits}) + \text{UPC odd digits})$$

The modulo 10 of this number is its remainder when divided by 10.

As an example, use the UPC in Fig. 2 to calculate the modulo 10. Here, the code symbol is zero and the code numbers that fall in even positions are 1, 3,

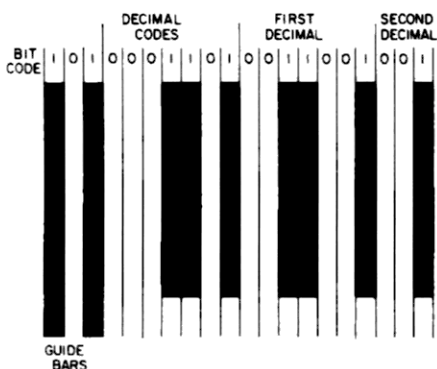


Figure 2. Ideal UPC.

2, 2, and 0. The UPC numbers in odd locations are 4, 7, 5, 5, and 1. So the modulo 10 equation looks like

$$\text{modulo } 10(3X(0+1+3+2+2+0)+4+7+5+5+1)$$

or 46 divided by 10, or 4.6. The re-

mainder, 6, is the modulo 10 of this UPC.

Once the computer determines the modulo 10, it uses this figure to determine the check digit using the equation

$$0 = 10 - (\text{modulo } 10 + \text{the check digit})$$

The check digit is encoded into the UPC so that, when the calculation uses the self-check calculation, it produces a value of zero if all the UPC numbers are properly read.

The check digit for this particular UPC is 4. The calculation is now

$$0 = 10 - (6 + 4)$$

Since both sides of the equation are equal to zero, the computer indicates a successful read of the UPC in the example above.

Code Structure

The actual structure of the code makes it possible to scan from either direction. The UPC has two codes (right and left) separated by one guide strip. This guide strip is a binary representation of 01010. Guide strips appear at either end of the code sequence so that the binary code 101 identifies the start or finish of the code. Figure 1 shows these as the bars that extend below the code. Table 2 is a representation of the binary code sequences for the UPC.

These left/right bit codes provide further checks of scanning accuracy. The left code begins with a logic 1 and ends with a logic zero while the right code begins with a logic zero and ends

Program Listing. UPC-A printer.

```

0030 43
0031 4F
0032 55
0033 52
0034 53
0035 45
0036 20
0037 50
0038 4C
0039 41
003A 54
003B 54
003C 45
003D 4E
003E 20
003F 53
0040 48
0041 49
0042 46
0043 54
0044 40
0045 22
0046 53
0047 48
0048 49
0049 46
004A 54
004B 22
004C 20
004D 55
004E 50
004F 20
0050 41
0051 52

```

00190 DEFM ' PLATTEN SHIFT@'

00200 MSG3 DEFM '"SHIFT" UP ARRO'

Listing continued

Listing continued

```

8052 52
8053 4F
8054 5/      00210      DEFM      'W FINE PLATTEN '
8055 20
8056 46
8057 49
8058 4E
8059 45
805A 20
805B 50
805C 4C
805D 41
805E 54
805F 54
8060 45
8061 4E
8062 20
8063 53      00220      DEFM      'SHIFT@'
8064 48
8065 49
8066 46
8067 54
8068 40
8069 45      00230 MSG4      DEFM      'ERROR IN PRINT '
806A 52
806B 52
806C 4F
806D 52
806E 20
8000

00000      ORG      8000H
00010 ;*****
00020 ;* UNIVERSIAL PRODUCT CODE
00030 ;* UPCA
00040 ;* PRINTER
00050 ;* BY DAVEY S. THORNTON
00060 ;* 8128 BRUCAR COURT
00070 ;* GAITHERSBURG, MARYLAND 20877
00080 ;*****
00090 CURAD2 EQU 3C40H
00100 CURAD3 EQU 3C80H
00110 CLSCN EQU 1C9H
00120 PRTOUT EQU 0F8H
00130 CURADS EQU 3C00H
00140 KBWAIT EQU 49H
00150 MSG1 DEFM 'FRAME PRINTER ('

3C40
3C80
01C9
00F8
3C00
0049
8000 46
8001 52
8002 41
8003 4D
8004 45
8005 20
8006 50
8007 52
8008 49
8009 4E
800A 54
800B 45
800C 52
800D 20
800E 28
800F 44      00160      DEFM      'DEPRESS "ENTER"'
8010 45
8011 50
8012 52
8013 45
8014 53
8015 53
8016 20
8017 22
8018 45
8019 4E
801A 54
801B 45
801C 52
801D 22
801E 20      00170      DEFM      ' TO EXIT@'
801F 54
8020 4F
8021 20
8022 45
8023 58
8024 49
8025 54
8026 40
8027 55      00180 MSG2      DEFM      'UP ARROW COURSE'
8028 50
8029 20
802A 41
802B 52
802C 52
802D 4F
802E 57
802F 20
806F 49
8070 4E
8071 20
8072 50
8073 52
8074 49
8075 4E
8076 54
8077 20
8078 43      00240      DEFM      'CHARACTER@'
8079 48
807A 41
807B 52

```

Listing continued

with a logic 1. Further, the left code has an odd parity (odd number of logic 1's) and the right code has an even parity. Uniquely identified by its structure, the code provides multiple methods to check accuracy.

Look at the code closely and notice that the 5 binary bits that represent the decimal code (excluding the first and seventh bits) provide 16 code combinations with odd parity and 16 codes with even parity. Of this 32-code total, the UPC uses only 20 so that each code sequence has two light and two dark bars.

With the code uniquely identified, you can devise a print algorithm that

Digit	Representation	
	Left	Right
0	0001101	1110010
1	0011001	1100110
2	0010011	1101100
3	0111101	1000010
4	0100011	1011100
5	0110001	1001110
6	0101111	1010000
7	0111011	1000100
8	0110111	1001000
9	0001011	1110100

Table 2. UPC left/right bit codes.

1 dot/bar logic		2 dots/bar logic		3 dots/bar logic		number of bars/spaces
1	0	1	0	1	0	
.01388	.01072	.02208	.18920	.03028	.02712	1
.01104	.00946	.01924	.01766	.02744	.02586	2
.01009	.00904	.01827	.01724	.02649	.02544	3
.00962	.00883	.01782	.01703	.02602	.02523	4

Table 3. Dot-matrix bar/space widths.

suitably prints the desired code. I wrote the program in Assembly language in order to improve the speed at which the program prints. To print the bar codes with a dot-matrix printer, you must ensure that the bars and spaces produced by the printer are acceptable to the scanning algorithm (see the Program Listing).

Printing the UPC

Figure 2 shows an ideal UPC bar code divided into equal segments defining the bars and spaces. The closer the printed code comes to this ideal, the greater the first-read rate.

The dot-matrix printer prints bars by using dots as shown in Fig. 3. The minimum dot separation and the dot overlap caused by the constraints cause variation in the thickness of the bars and spaces (see Table 3).

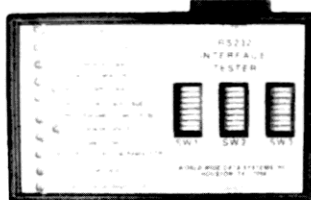
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COMPUTEX

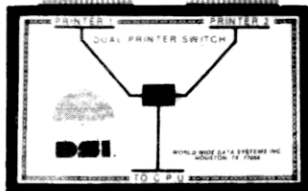
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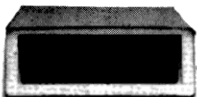
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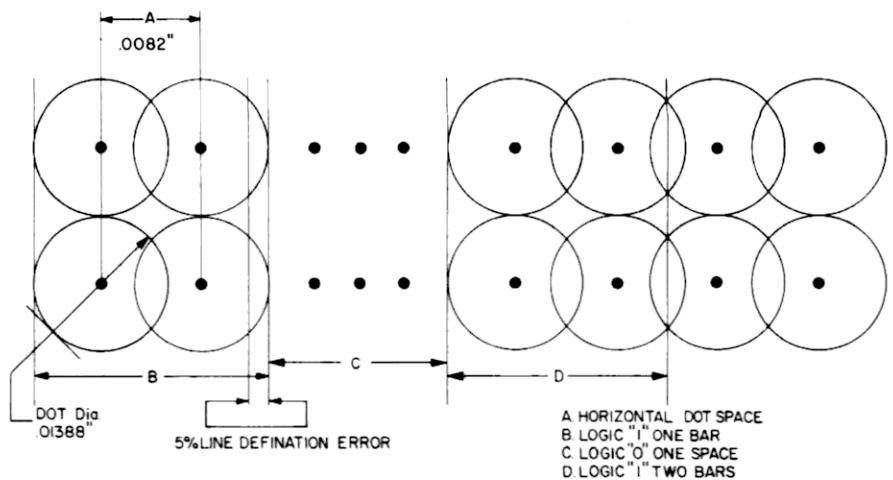


Figure 3. Printer dot pattern.

definition of the spaces. Since the bordering bars define the space, the radius of a single dot at each bar/space border reduces the actual width of the space. To overcome this problem, the print algorithm inserts two additional spaces with each group of spaces.

Figure 4 outlines the algorithm for printing UPC bar codes. The flowchart shows the six major modules of the

print programs. First you enter the data and the program checks to ensure that it is an ASCII representation for decimals zero through 9. Next it converts the data from ASCII to decimal by subtracting 30 hex. It then exchanges these decimal digits for their corresponding bit patterns (see Table 2).

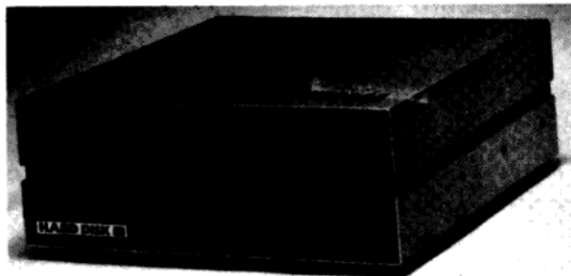
It loads these patterns into a bit buffer that contains the guide bar codes, and

Listing continued

807C 41			
807D 43			
807E 54			
807F 45			
8080 52			
8081 40			
8082 7266	00250 PNTRT	DEFW	6672H
8084 6C42	00260	DEFW	426CH
8086 5C4E	00270	DEFW	4E5CH
8088 5044	00280	DEFW	4450H
808A 4874	00290	DEFW	7448H
808C 0D19	00300 PNTLT	DEFW	190DH
808E 133D	00310	DEFW	3D13H
8090 2331	00320	DEFW	3123H
8092 2F3B	00330	DEFW	3B2FH
8094 370B	00340	DEFW	0B37H
8096 FF00	00350 BITBUF	DEFW	0FFH
8098 00FF	00360	DEFW	0FF00H
8036	00370 LPRNT	DEFS	36H
80D0 0000	00380	DEFW	0
80D2 FF00	00390	DEFW	0FFH
80D4 00FF	00400	DEFW	0FF00H
80D6 0000	00410	DEFW	0
8036	00420 RPRNT	DEFS	36H
810E FF00	00430	DEFW	0FFH
8110 00FF	00440	DEFW	0FF00H
8112 3031	00450 DIGBUF	DEFW	3130H
8114 3233	00460	DEFW	3332H
8116 3435	00470	DEFW	3534H
8118 3637	00480	DEFW	3736H
811A 3839	00490	DEFW	3938H
811C 30	00500	DEFB	30H
811D 31	00510 DIGCK	DEFB	31H
000C	00520 DIGITS	DEFS	0CH
812A 06	00530 SKPLN	DEFB	6
812B 05	00540 TABLN	DEFB	5
812C 45	00550 MSG5	DEFW	'ENTER CODE SYMB'
812D 4E			
812E 54			
812F 45			
8130 52			
8131 20			
8132 43			
8133 4F			
8134 44			
8135 45			
8136 20			
8137 53			
8138 59			
8139 4D			
813A 42			

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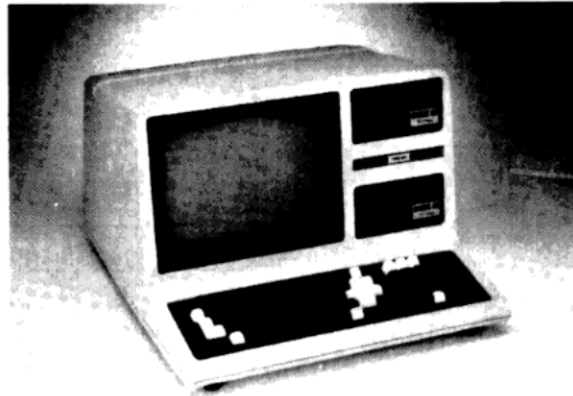
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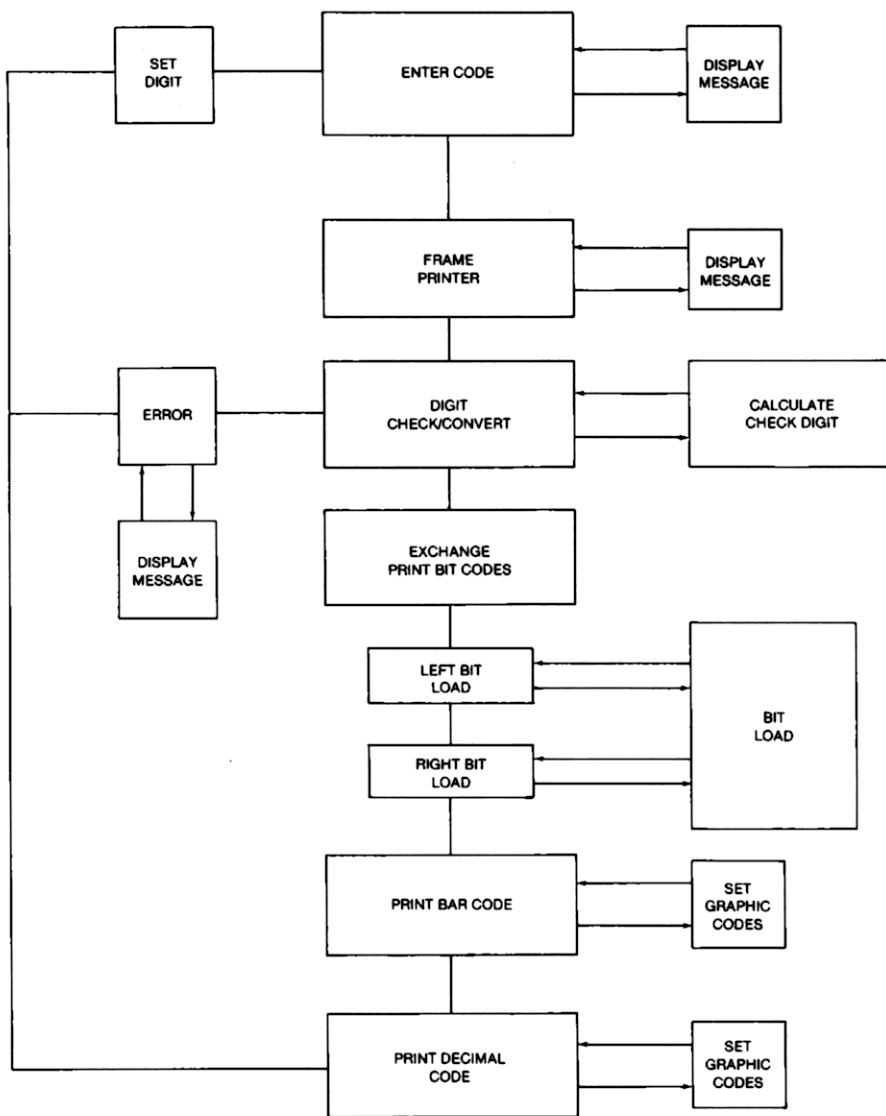


Figure 4. UPC print flow diagram.

passes control to the bar code print routine. The print routine passes the contents of the bit buffer to the printer substituting 255 for the logic 1s. This drives the printer in the dot graphic mode to fire all or none of the dot print pins during the print operation.

The program has an additional feature which allows the printer to advance a line or a portion of a line to set the print head in a desired position. This is called framing and is available prior to each bar code print sequence. Another point to mention is that the printer only prints in one direction. This is because the printer drifts when it prints in two directions. This has an adverse effect on the quality of the printed bar code.

The minimum width chosen for bars and spaces fixes the length of the code. Ideally, this is easy to calculate but for the dot-matrix printer, you must take other things into consideration. The code sequence has 29 spaces and 30 bars including the guide bars. The equation below gives the overall length of the code that considers the addition of spaces to compensate for bar overlap.

$$L = .01388 + 95 * (.0083) * n + 29 * (.0083) * 2$$

where n equals the number of dots defining minimum width. Table 4 gives

n	Minimum width		Code length (inches)
	Bars	Spaces	
1	.01388	.01102	1.28
2	.02221	.01932	2.07
3	.03048	.02762	2.86
4	.0388	.0359	3.65

Table 4. UPC bar code lengths.

the minimum bar/space widths and lengths for each of the code specifications.

The Test

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Listing continued

```

813B 4F      00560      DEFM      'OL 0-90'
813C 4C
813D 20
813E 30
813F 2D
8140 39
8141 40
8142 45      00570 MSG6      DEFM      'ENTER 10 DIGIT '
8143 4E
8144 54
8145 45
8146 52
8147 20
8148 31
8149 30
814A 20
814B 44
814C 49
814D 47
814E 49
814F 54
8150 20
8151 44      00580      DEFM      'DECIMAL CODES0'
8152 45
8153 43
8154 49
8155 4D
8156 41
8157 4C
8158 20
8159 43
  
```

Listing continued

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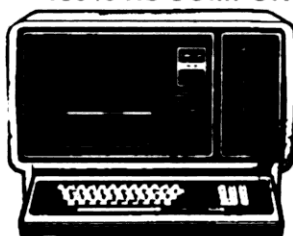
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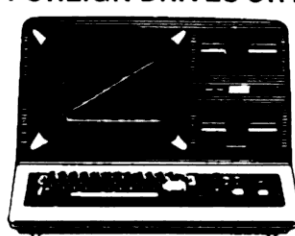
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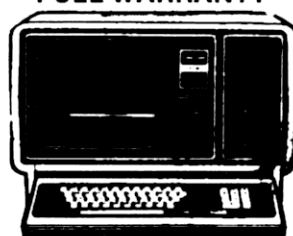
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```

815A 4F
815B 44
815C 45
815D 53
815E 40
815F 2D      00590 MSG7      DEFM      '-----@'
8160 2D
8161 2D
8162 2D
8163 2D
8164 2D
8165 2D
8166 2D
8167 2D
8168 2D
8169 40

00600 ;*****
00610 ;*      SET DIGIT BUFFER
00620 ;*****

816A 3E30      00630 BEGIN      LD      A,30H
816C 060C      00640          LD      B,0CH
816E 211281    00650          LD      HL,DIGBUF
8171 77        00660          LD      (HL),A
8172 23        00670          INC     HL
8173 10FC      00680          DJNZ    SETLOP
00690 ;*****
00700 ;*      ENTER CODES
00710 ;*****

8175 CDC901    00720          CALL    CLSCN
8178 DD21003C  00730          LD      IX,CURADS
817C 212C81    00740          LD      HL,MSG5
817F CD2884    00750          CALL    DSPMSG
00760 ;***      ENTER CODE SYMBOL
8182 CD4900    00770          CALL    KWAIT
8185 FD211281  00780          LD      IY,DIGBUF
8189 FD7700    00790          LD      (IY),A
818C FD23      00800          INC     IY
818E CDC901    00810          CALL    CLSCN
8191 DD21003C  00820          LD      IX,CURADS
8195 214281    00830          LD      HL,MSG6
8198 CD2884    00840          CALL    DSPMSG
819B DD21403C  00850          LD      IX,CURAD2
819F 215F81    00860          LD      HL,MSG7
81A2 CD2884    00870          CALL    DSPMSG
81A5 DD21803C  00880          LD      IX,CURAD3
00890 ;***      ENTER 10 DIGIT CODE
81A9 060A      00900          LD      B,0AH
81AB CD4900    00910          ENTDIG   CALL    KWAIT
81AE FD7700    00920          LD      (IY),A
81B1 DD7700    00930          LD      (IX),A
81B4 FD23      00940          INC     IY
81B6 DD23      00950          INC     IX
81B8 10F1      00960          DJNZ    ENTDIG
00970 ;*****
00980 ;*      FRAME PRINTER
00990 ;*****

81BA CDC901    01000          START   CALL    CLSCN
81BD DD21003C  01010          LD      IX,CURADS
81C1 210080    01020          LD      HL,MSG1
81C4 CD2884    01030          CALL    DSPMSG
81C7 DD21403C  01040          LD      IX,CURAD2
81CB 212780    01050          LD      HL,MSG2
81CE CD2884    01060          CALL    DSPMSG
81D1 DD21803C  01070          LD      IX,CURAD3
81D5 214580    01080          LD      HL,MSG3
81D8 CD2884    01090          CALL    DSPMSG
01100 ;
01110 ;      KEYBOARD LOOP "ENTER" TO EXIT
01120 ;

81DB CD4900    01130          KBLOOP   CALL    KWAIT
81DE F5        01140          PUSH    AF
81DF F5        01150          PUSH    AF
81E0 FE5B      01160          CP      5BH
01170 ;
81E2 280C      01180          JR      2,COURSE
81E4 F1        01190          POP     AF
81E5 FE1B      01200          CP      1BH
01210 ;
81E7 2818      01220          JR      2,FINE
81E9 F1        01230          POP     AF
81EA FE0D      01240          CP      0DH
01250 ;
81EC 2828      01260          JR      2,ENTER
81EE 18EB      01270          JR      KBLOOP
01280 ;****      COURSE SHIFT
81F0 3E9B      01290          COURSE   LD      A,9BH
81F2 CD3B84    01300          CALL    OUTPUT
81F5 3E30      01310          LD      A,30H
81F7 CD3B84    01320          CALL    OUTPUT
81FA 3E0A      01330          LD      A,0AH
81FC CD3B84    01340          CALL    OUTPUT
81FF 18DA      01350          JR      KBLOOP
01360 ;****      FINE LINE FEED
8201 CD4884    01370          FINE     CALL    ESCAP
8204 3E41      01380          LD      A,41H
8206 CD3B84    01390          CALL    OUTPUT
8209 3E02      01400          LD      A,2
820B CD3B84    01410          CALL    OUTPUT
820E CD4E84    01420          CALL    CARRET
8211 CD5784    01430          CALL    LNFEED
8214 18C5      01440          JR      KBLOOP
01450 ;****      ENTER (EXIT)
8216 3E9B      01460          ENTER   LD      A,9BH
8218 CD3B84    01470          CALL    OUTPUT
821B 3E40      01480          LD      A,40H
821D CD3B84    01490          CALL    OUTPUT

01500 ;*****
01510 ;*      DIGIT CHECK/CONVERT
01520 ;*****

8220 060C      01530          LD      B,0CH
8222 211281    01540          LD      HL,DIGBUF
8225 DD211E81  01550          LD      IX,DIGITS
8229 7E        01560          DIGLOP   LD      A,(HL)
822A 37        01570          SCF
822B 3F        01580          CCF
822C DE30      01590          SBC     A,30H
822E 77        01600          LD      (HL),A
822F DD7700    01610          LD      (IX),A
8232 3002      01620          JR      NC,UPLMT
8234 1810      01630          JR      ERROR
8236 FE0A      01640          UPLMT   CP      0AH
8238 3802      01650          JR      C,CNTU
823A 180A      01660          JR      ERROR
823C 23        01670          CNTU    INC     HL
823D DD23      01680          INC     IX
823F 10E8      01690          DJNZ    DIGLOP
8241 CD9983    01700          CALL    CALCDT
8244 1810      01710          JR      EXPBT
01720 ;*****
01730 ;*      ERROR      SUBROUTINE
01740 ;*****

8246 CDC901    01750          ERROR   CALL    CLSCN
8249 DD21003C  01760          LD      IX,CURADS
824D 216980    01770          LD      HL,MSG4
8250 CD2884    01780          CALL    DSPMSG
8253 C36A81    01790          JP      BEGIN
01800 ;
01810 ;*      EXCHANGE PRINT BIT CODES
01820 ;*****

8256 0606      01830          EXPBT   LD      B,6
8258 CD5784    01840          CALL    LNFEED
825B 0606      01850          LD      B,6
825D DD211281  01860          LD      IX,DIGBUF
8261 1600      01870          LD      D,0
8263 218C80    01880          LD      HL,PNTLT
8266 DD5E00    01890          EXC1    LD      E,(IX)
8269 E5        01900          PUSH    HL
826A 19        01910          ADD     HL,DE
826B 7E        01920          LD      A,(HL)
826C DD7700    01930          LD      (IX),A
826F DD23      01940          INC     IX
8271 E1        01950          POP     HL
8272 10F2      01960          DJNZ    EXC1
8274 0606      01970          LD      B,6
8276 218280    01980          LD      HL,PNTRT
8279 DD5E00    01990          EXC2    LD      E,(IX)
827C E5        02000          PUSH    HL
827D 19        02010          ADD     HL,DE
827E 7E        02020          LD      A,(HL)
827F DD7700    02030          LD      (IX),A
8282 DD23      02040          INC     IX
8284 E1        02050          POP     HL
8285 10F2      02060          DJNZ    EXC2
02070 ;*****
02080 ;*      LEFT BIT LOAD
02090 ;*****

8287 FD219A80  02100          LD      IY,LPRNT
828B 0606      02110          LD      B,6
828D DD211281  02120          LD      IX,DIGBUF
8291 DD7E00    02130          LTBTL   LD      A,(IX)
8294 DD23      02140          INC     IX
8296 CDF183    02150          CALL    BITLOD
8299 10F6      02160          DJNZ    LTBTL
02170 ;*****
02180 ;*      RIGHT BIT LOAD
02190 ;*****

829B 0606      02200          LD      B,6
829D FD21D880  02210          LD      IY,RPRNT
82A1 DD7E00    02220          RTBTL   LD      A,(IX)
82A4 DD23      02230          INC     IX
82A6 CDF183    02240          CALL    BITLOD
82A9 10F6      02250          DJNZ    RTBTL
02260 ;*****
02270 ;*      PRINT BAR CODE
02280 ;*****

82AB D9        02290          EXX
82AC 060C      02300          LD      B,0CH
82AE D9        02310          OUTNXT  EXX
02320 ;
82AF CD6984    02330          CALL    TABIND
82B2 CD4884    02340          CALL    ESCAP
82B5 3E41      02350          LD      A,41H
82B7 CD3B84    02360          CALL    OUTPUT
82BA 3E04      02370          LD      A,4
82BC CD3B84    02380          CALL    OUTPUT
82BF CDDA83    02390          CALL    GRFSET
02400 ;      PRINT LOOP
82C2 DD219680  02410          LD      IX,BITBUF
82C6 067C      02420          LD      B,7CH
82C8 DD7E00    02430          OUTLOP  LD      A,(IX)
82CB CD3B84    02440          CALL    OUTPUT
82CE CD3B84    02450          CALL    OUTPUT
82D1 DD23      02460          INC     IX
82D3 10F3      02470          DJNZ    OUTLOP
82D5 CD4E84    02480          CALL    CARRET
82D8 CD5784    02490          CALL    LNFEED
02500 ;
82DB CD4884    02510          ESC      "0"  RESET PRINTER
82DE 3E40      02520          LD      A,40H
82E0 CD3B84    02530          CALL    OUTPUT
82E3 D9        02540          EXX
82E4 10C8      02550          DJNZ    OUTNXT

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82E6 CD4884 02560 CALL ESCAP
82E9 3E40 02570 LD A,40H
82EB CD3B84 02580 CALL OUTPUT
82EE D9 02590 EXX
02600 ;*****
02610 ;* PRINT NUMERIC CODE
02620 ;*****
82EF DD219A80 02630 LD IX,LPRNT
82F3 0636 02640 LD B,36H
82F5 3E00 02650 LD A,0
02660 ;
82F7 DD7700 02670 LBUFC LD (IX),A
82FA DD23 02680 INC IX
82FC 10F9 02690 DJNZ LBUFC
82FE DD21D800 02700 LD IX,RPRNT
8302 0636 02710 LD B,36H
8304 DD7700 02720 RBUFC LD (IX),A
8307 DD23 02730 INC IX
8309 10F9 02740 DJNZ RBUFC
830B CD6984 02750 CALL TABIND
830E CDDA83 02760 CALL GRFSET
8311 067C 02770 LD B,7CH
8313 DD219680 02780 LD IX,BITBUF
8317 DD7E00 02790 PBUF LD A,(IX)
831A DD23 02800 INC IX
831C CD3B84 02810 CALL OUTPUT
831F CD3B84 02820 CALL OUTPUT
8322 10F3 02830 DJNZ PBUF
02840 ; SET LINE SPACING TO 5/216 INCH
8324 CD4884 02850 CALL ESCAP
8327 3E41 02860 LD A,41H
8329 CD3B84 02870 CALL OUTPUT
832C 3E05 02880 LD A,5
832E CD3B84 02890 CALL OUTPUT
8331 CD4E84 02900 CALL CARRET
8334 CD5784 02910 CALL LNFEED
02920 ; PRINT NUMERIC VALUES
8337 CD6984 02930 CALL TABIND
833A 3E94 02940 LD A,94H
833C CD3B84 02950 CALL OUTPUT
833F 3E20 02960 LD A,20H
8341 CD3B84 02970 CALL OUTPUT
8344 DD211E81 02980 LD IX,DIGITS
8348 DD7E00 02990 LD A,(IX)
834B C630 03000 ADD A,30H
834D CD3B84 03010 CALL OUTPUT
8350 3E20 03020 LD A,20H
8352 CD3B84 03030 CALL OUTPUT
8355 CD3B84 03040 CALL OUTPUT
8358 0605 03050 LD B,5
835A DD23 03060 INC IX
835C DD7E00 03070 NUMLP1 LD A,(IX)
835F C630 03080 ADD A,30H
8361 CD3B84 03090 CALL OUTPUT
8364 DD23 03100 INC IX
8366 10F4 03110 DJNZ NUMLP1
8368 3E20 03120 LD A,20H
836A CD3B84 03130 CALL OUTPUT
836D CD3B84 03140 CALL OUTPUT
8370 CD3B84 03150 CALL OUTPUT
8373 CD3B84 03160 CALL OUTPUT
8376 0605 03170 LD B,5
8378 DD7E00 03180 NUMLP2 LD A,(IX)
837B C630 03190 ADD A,30H
837D CD3B84 03200 CALL OUTPUT
8380 DD23 03210 INC IX
8382 10F4 03220 DJNZ NUMLP2
8384 CD4E84 03230 CALL CARRET
8387 CD5784 03240 CALL LNFEED
838A CD6084 03250 CALL NORMLS
838D 3A2A81 03260 LD A,(SKPLN)
8390 47 03270 LD B,A
8391 CD5784 03280 LFEDLP CALL LNFEED
8394 10FB 03290 DJNZ LFEDLP
8396 C36A81 03300 RTN5 JP BEGIN
03310 ;*****
03320 ;* CALCULATE CHECK DIGIT SUBROUTINE
03330 ;*****
8399 DD211E81 03340 CALCDT LD IX,DIGITS
839D DD7E00 03350 LD A,(IX)
83A0 87 03360 ADD A,A
83A1 27 03370 DAA
83A2 DD8600 03380 ADD A,(IX)
83A5 27 03390 DAA
83A6 0605 03400 LD B,5
83A8 DD23 03410 INC IX
83AA DD8600 03420 ADDLOP ADD A,(IX)
83AD 27 03430 DAA
83AE DD23 03440 INC IX
83B0 DD8600 03450 ADD A,(IX)
83B3 27 03460 DAA
83B4 DD8600 03470 ADD A,(IX)
83B7 27 03480 DAA
83B8 DD8600 03490 ADD A,(IX)
83BB 27 03500 DAA
83BC DD23 03510 INC IX
83BE 10EA 03520 DJNZ ADDLOP
83C0 F6F0 03530 OR 0FH
83C2 E60F 03540 AND 0FH
83C4 47 03550 LD B,A
83C5 3E0A 03560 LD A,0AH
83C7 37 03570 SCF
83C8 3F 03580 CCF
83C9 98 03590 SBC A,B
83CA 27 03600 DAA
83CB F6F0 03610 OR 0FH

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83CD E60F 03620 AND 0FH
83CF DD7700 03630 LD (IX),A
83D2 DD211D81 03640 LD IX,DIGCK
83D6 DD7700 03650 LD (IX),A
83D9 C9 03660 RET
03670 ;*****
03680 ;* GRFSET SUBROUTINE
03690 ;*****
83DA DD219680 03700 GRFSET LD IX,BITBUF
03710 ; SET DOT GRAPHICS N1&N2
83DE CD4884 03720 CALL ESCAP
83E1 3E4C 03730 LD A,4CH
83E3 CD3B84 03740 CALL OUTPUT
83E6 3EF8 03750 LD A,0FH
83E8 CD3B84 03760 CALL OUTPUT
83EB 3E00 03770 LD A,0
83ED CD3B84 03780 CALL OUTPUT
83F0 C9 03790 RET
03800 ;*****
03810 ;* BIT LOAD SUBROUTINE
03820 ;*****
83F1 D5 03830 BITLOD PUSH DE
83F2 E5 03840 PUSH HL
83F3 07 03850 RLCA
83F4 07 03860 BIT1 RLCA
83F5 210700 03870 LD HL,7
83F8 110100 03880 LD DE,1
83FB 3011 03890 JR NC,SPACES
83FD FD3600FF 03900 BARS LD (IX),0FFH
8401 FD23 03910 INC IX
03920 ; CHECK FOR LAST BIT
8403 37 03930 SCF
8404 3F 03940 CCF
8405 ED52 03950 SBC HL,DE
8407 281C 03960 JR Z,RTN1
8409 07 03970 RLCA
840A 3002 03980 JR NC,SPACES
840C 18EF 03990 JR BARS
840E FD360000 04000 SPACES LD (IX),0
8412 FD23 04010 INC IX
8414 FD360000 04020 SPAC1 LD (IX),0
8418 FD23 04030 INC IX
04040 ; CHECK FOR LAST BIT
841A 37 04050 SCF
841B 3F 04060 CCF
841C ED52 04070 SBC HL,DE
841E 2805 04080 JR Z,RTN1
8420 07 04090 RLCA
8421 30F1 04100 JR NC,SPAC1
8423 18D8 04110 JR BARS
8425 E1 04120 RTN1 POP HL
8426 D1 04130 POP DE
8427 C9 04140 RET
04150 ;*****
04160 ;* DISPLAY MESSAGE SUBROUTINE
04170 ;*****
8428 0640 04180 DSPMSG LD B,40H
842A 7E 04190 DSPLOP LD A,(HL)
842B F5 04200 PUSH AF
842C FE40 04210 CP 40H
842E 2809 04220 JR Z,RTN2
8430 F1 04230 POP AF
8431 DD7700 04240 LD (IX),A
8434 23 04250 INC HL
8435 DD23 04260 INC IX
8437 10F1 04270 DJNZ DSPLOP
8439 F1 04280 RNT2 POP AF
843A C9 04290 RET
04300 ;*****
04310 ;* OUTPUT SUBROUTINE
04320 ;*****
843B F5 04330 OUTPUT PUSH AF
843C DBF8 04340 LOOPOT IN A,(0FH)
843E E6F0 04350 AND 0FH
8440 FE30 04360 CP 30H
8442 20F8 04370 JR NZ,LOOPOT
8444 F1 04380 POP AF
8445 D3F8 04390 OUT (0FH),A
8447 C9 04400 RET
8448 3E1B 04410 ESCAP LD A,1BH
844A CD3B84 04420 CALL OUTPUT
844D C9 04430 RET
844E CD4884 04440 CARRET CALL ESCAP
8451 3E8E 04450 LD A,8EH
8453 CD3B84 04460 CALL OUTPUT
8456 C9 04470 RET
8457 CD4884 04480 LNFEED CALL ESCAP
845A 3E8A 04490 LD A,8AH
845C CD3B84 04500 CALL OUTPUT
845F C9 04510 RET
8460 CD4884 04520 NORMLS CALL ESCAP
8463 3E32 04530 LD A,32H
8465 CD3B84 04540 CALL OUTPUT
8468 C9 04550 RET
04560 ;*****
04570 ;* INDENT CODE SUBROUTINE
04580 ;*****
8469 3A2B81 04590 TABIND LD A,(TABLN)
846C 47 04600 LD B,A
846D 3E20 04610 LD A,20H
846F CD3B84 04620 TBLOOP CALL OUTPUT
8472 10FB 04630 DJNZ TBLOOP
8474 CD4E84 04640 CALL CARRET
8477 C9 04650 RET
816A 04660 END BEGIN
00000 Total Errors

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The test consisted of formatting 40 tracks on the diskette and writing a 6DB6 data pattern on all tracks. The 6DB6 pattern was chosen because it is recommended as a "worst case" test by manufacturers of drives and diskettes. An attempt was then made to read each sector on the disk once - no retries. Operating system was Newdos/80, Version 1.0, with Double Zap, Version 2.0. Unreadable sectors were tallied and recorded. The test was run ten times with each double density controller and the data averaged. Test results are shown in the table.

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LNW "LNDOUBLER"	202

Note: test results available upon written request. All tests conducted prior to 8-25-81

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PERCOM "DOUBLER A"	250	0
LNW "LNDOUBLER"	202	0

Note: Same test procedures as "DDC".

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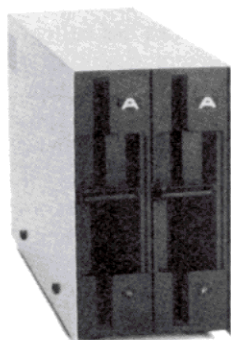
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- ★ One Drive System Kit \$369
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- ★ NEWDOS/80, 2.0 (Mod. I or III)..... \$129
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- ★ MX80 ribbons..... \$9
- ★ 5.25" Drive Power Supply & case..... \$59
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Decoding Bar Codes

by Robert S. Craft and Richard G. Beplat



Now that you have a solid background in bar codes, you're ready to use them with these applications programs and your Model III.

Okay, you've heard all about bar codes. You know they're a fast, efficient, and accurate means of data input. You've read about UPC, 2 of 5, 3 of 9, and Codabar codes, and modulo 10s, check characters, and read rates. You know that there are many scanners and readers on the market, but as of yet you haven't found a way to use one

with a Model III.

This article brings bar code technology to Model III owners. It includes sample programs for the three types of bar code data transmission—on-line, talk-only, and block-transfer uploads—that you use in a wide variety of applications, such as point-of-issue (or -sale) inventory control, materials tracking,

document control, property control, library status, transaction recording, and more.

Converting to Bar Codes

Bar code readers scan and interpret bar code labels to produce a series of ASCII characters that the computer accepts and processes. An important aspect of adding bar code technology to any microcomputer application is a well-thought-out data manipulation plan.

Converting existing applications to bar code technology requires additional processing operations. It is important, therefore, that you understand how software handles bar code data.

You may have to modify your existing applications programs to accept information that you normally enter through the keyboard from the bar code reader or from a specially created file on a mass storage medium. Applications that require a software package written from scratch can use either technique.

We'll present examples of programming each way. These techniques apply not only to bar codes, but to almost any portable data collection device, and many other peripheral devices that transmit data to a microcomputer.

The key to using a bar code reader with a microcomputer is communication between the two devices. This involves both hardware and software compatibility.

Program Listing 1.

```

10 CLS
20 '
30 ' BAR CODE DEMONSTRATION PROGRAM #1
40 ' ON-LINE USE OF A BAR CODE READER
50 ' in a MENU DRIVEN APPLICATION PROGRAM
60 '
70 ' by:
80 ' R.S. Craft & R.G. Beplat
90 ' of:
100 ' TAURIO CORPORATION
110 '
120 ' This program is intended for use on the
130 ' TRS-80 Model III / 48K ram / 2 Disks / RS-232C
140 ' under the
150 ' DOSPLUS 3.5 operating system,
160 ' by Micro-Systems Software, Inc.
170 '
180 CMD"RS232 (WAIT=N)"
190 CLEAR 500
200 DEFSTR A
210 INPUT@448,"Enter today's date as MM/DD/YY ",8,"$";AT
220 CMD"FORCE @KI @RS"
230 CLS
240 OPEN "D",1,"DOCDAT:1",64
250 FIELD 1,50 AS AA,3 AS AB,3 AS AC,8 AS AD
260 R1=LOF(1)
270 OPEN "D",2,"USRDAT:1",16
280 FIELD 2,10 AS A1,5 AS A2,1 AS A3
290 R2=LOF(2)
300 CLS
310 LPRINT "*****"
320 PRINTCHR$(23)
330 PRINT@86,"MAIN MENU"
340 PRINT@202,"WAND: FOR:"

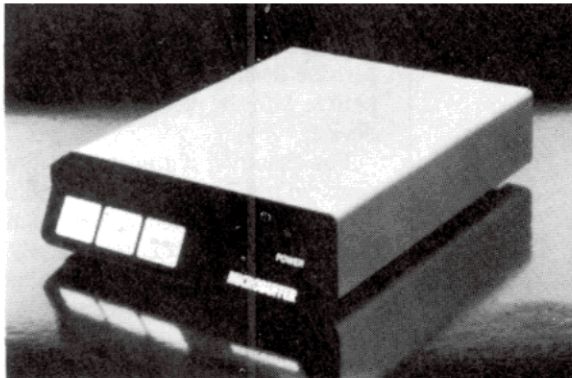
```

Listing 1 continued

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How It Works

The MBIP in-line parallel buffer works with almost any computer/printer combination utilizing a Centronics type parallel interface. Available with up to 256K of RAM for data buffering, the MBIP can accept very large files for buffering as fast as your computer can send it.

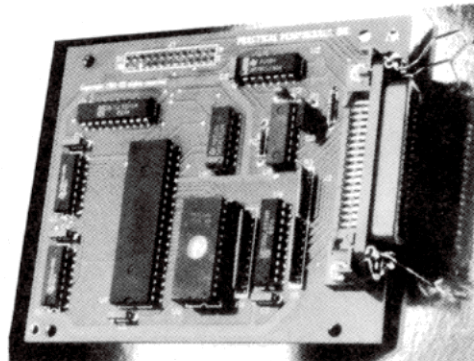
Saves Time

Most computers are able to send data to the printer at very high speeds, usually much faster than the printer can print it. The MBIP, placed between the computer and the printer, accepts this data as fast as the computer can send it, stores it in its own memory and then sends it on to the printer at the printer's own speed. Under normal circumstances without a MBIP the computer could be tied up for hours on a large file being dumped into the printer costing you valuable time and money.

Improves Efficiency

Using the MBIP's touch sensitive front panel controls, multiple copies of your document can be made without tying up the computer any further. Printing may be halted at any point and continued where it left off later. You can even turn your computer off and the MBIP will continue until the print job is complete.

The MBIP requires no user modifications of software and installs in seconds with virtually any computer (including TRS-80, ATARI, IBM-PC, APPLE, OSBORNE, NEC etc.) and any printer (including EPSON, CENTRONICS, NEC, C.I.TOH, IDS, ANADEx, OKIDATA, IBM PERSONAL etc.), dimensions are 5 1/8" W x 7 3/4" D x 1 3/8" H.



INTERNAL PARALLEL BUFFER FOR EPSON

MBP	MBP	MBP
16K	32K	64K
\$159.95	\$199.95	\$249.95

Operation

The MBP is an intelligent Centronic-Compatible parallel interface for the Epson MX-80, MX-80 F/T, and MX-100 printers, with 16K, 32K, 64K bytes of on-board RAM for data buffering. FX80 and FX100 compatible.

Eliminates Printer Bottleneck

The buffering capability of the MBP increases your data processing efficiency by eliminating the wait normally experienced while printing. An Epson printer prints at 80 characters per second; at this speed it takes about five minutes to print a 16,000 character document. During most of this time the computer is waiting for Epson to finish one line so it can send the next. By using the MBP it takes the computer only *four seconds* to send a 16,000 character document. The Practical Peripherals MBP interface typically accepts data as fast as the computer can send it, until full, returning use of the computer to you while it handles the printing. You can continue with other processing while simultaneously printing data from a previous job, gaining all the time you normally would have spent waiting for the printer to finish. Any program that involves printed output will be speeded up using the MBP.

The MBP supports all standard Epson Commands, is compatible with GRAFTRAX-80, and is plug compatible with the standard Epson cable. THE MBP does not require any user software for control.

Installs In Minutes

The MBP is easy to install — it simply plugs into the existing auxiliary interface connector inside the Epson without modification of the printer.

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```

350 PRINT@334,"1      Withdrawal"
360 PRINT@462,"2      Return"
370 PRINT@590,"3      Status Printout"
380 PRINT@718,"9      Close of Business"
390 A=INKEY$
400 IF A<>"9" AND A<>"1" AND A<>"2" AND A<>"3" THEN GOTO 390
410 IF A="1" THEN GOTO 540
420 IF A="2" THEN GOTO 870
430 IF A="3" THEN GOTO 1000
440 CLS
450 PRINT"CLOSING FILES"
460 CLOSE
470 PRINT
480 PRINT"RETURNING TO KEYBOARD CONTROL"
490 CMD"FORCE @KI @KI"
500 PRINT
510 PRINT"RETURNING TO DOSPLUS 3.5"
520 PRINT
530 CMD
540 CLS
550 INPUT@64,"Wand Document Id Label  ",5,"$*";A
560 IF LEN(A)<>5 THEN GOTO 540
570 N=VAL(RIGHT$(A,4))
580 IF N>R1 THEN GOTO 540
590 GET#1,N
600 PRINT@192,AA:PRINT@320,AB
610 INPUT@448,"Wand User Id Label  ",4,"$*";A
620 IF LEN(A)<>4 THEN GOTO 800
630 M=VAL(LEFT$(A,3))-100
640 AZ=RIGHT$(A,1)
650 IF M>R2 THEN GOTO 800
660 GET#2,M
670 IF AZ<>A3 THEN GOTO 800
680 PRINT@512,A1;A2
690 PRINT@704,"DOCUMENT WITHDRAWAL APPROVED"
700 LPRINT AT
710 LPRINT "DOCUMENT RECORD # ";N
720 LPRINT AA,AB
730 LPRINT "ISSUED TO ";LEFT$(A,3)
740 LPRINT A1,A2
750 LSET AC=LEFT$(A,3)
760 LSET AD=AT
770 PUT#1,N
780 CLS
790 GOTO 310
800 CLS
810 PRINTCHR$(23)
820 PRINT@320,"WITHDRAWAL DENIED"
830 PRINT@640,"USER NOT AUTHORIZED"
840 FOR I=1 TO 2500:NEXT I
850 CLS
860 GOTO 320
870 CLS
880 INPUT@64,"Wand Document Id Label  ",5,"$*";A
890 N=VAL(RIGHT$(A,5))
900 IF N>R1 THEN GOTO 880
910 GET#1,N
920 PRINT@192,AA:PRINT@320,AB
930 PRINT@448,"RETURNED"
940 LSET AC=" "
950 LSET AD=" "
960 PUT#1,N
970 LPRINT AA,AB
980 LPRINT"RETURNED ";AT
990 GOTO 300
1000 CLS
1010 PRINTCHR$(23)
1020 PRINT@320,"Wand 4"
1030 PRINT@448,"when the printer is ready"
1040 A=INKEY$
1050 IF A<>"4" THEN GOTO 1040
1060 CLS
1070 LPRINT
1080 LPRINT AT
1090 LPRINT
1100 LPRINT"LABEL DOCUMENT
      CPY  USR  DATE"
1110 LPRINT
1120 FOR I=1 TO R1
1130 GET #1,I
1140 IF I<10 THEN AS="000"+RIGHT$(STR$(I),1):GOTO 1180
1150 IF I<100 THEN AS="00"+RIGHT$(STR$(I),2):GOTO 1180
1160 IF I<1000 THEN AS="0"+RIGHT$(STR$(I),3):GOTO 1180
1170 AS=RIGHT$(STR$(I),4)
1180 AR="D"+AS
1190 LPRINT AR;"  "AA;"  "AB;"  "AC;"  "AD
1200 NEXT I
1210 GOTO 300

```

Hardware Interfacing

Bar code software transfers ASCII data through an RS-232C serial input/output (I/O) interface, available as an option for both the microcomputer and most bar code readers. Consult the technical manuals for both devices before purchasing (or fabricating) the required interconnect cable. Proper cable selection ensures that the transmit line for one device connects to and is compatible with the receive line on the other device.

For example, if transmitted data appears on pin 2 on one device and on pin 3 on the other, then received data appears on pins 3 and 2, respectively. This requires a normal straight-through RS-232C cable. Should both devices use the

"Each bar code reader operates differently with modems."

data, then reverse pins 2 and 3 on one end of a normal RS-232C cable. This type of cable configuration is called null modem.

Parity, word length, baud rate, and number of stop bits are either switch- or menu-selectable on portable bar code readers and menu-selectable on the Model III. Set the same parameters for both devices.

You can also interface bar code readers with microcomputers via telephone lines. This requires a modem and modem software on the microcomputer end, and additional communication equipment on the bar code reader. Modem communication is well-suited to applications involving remote data acquisition and batch uploading.

Since each individual bar code reader operates differently with modems, the manufacturer is the best source of information concerning modem interfacing. The software discussion that follows concerns only direct connection through the RS-232C serial interface. Note that the same application programming principles apply to batch processing whether you upload data directly or through a modem link.

Software

Program Listings 1, 2, and 3 provide the software needed to interface bar

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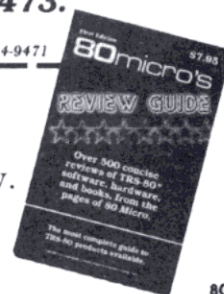
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code readers with your Model III. The data manipulation and storage techniques demonstrate the relative ease with which you can implement a plan.

After experimenting with a number of the disk operating systems available for the Model III, we found DOSPLUS 3.5 by Micro-Systems Software to be the choice for interfacing input devices through the serial port. The programs here only operate under DOSPLUS 3.5. After you boot the system and before

loading Basic, install the RS-232 driver. Do so with the command:

ASSIGN @ RS RS/DVR

If you attempt to invoke this command from Basic using the CMD function, the system performs a warm boot back to the operating system (not Basic) on completion of the driver installation.

Once you install the driver, set the communication parameters (baud rate,

word length, number of stop bits, parity, and wait mode). When initialized, the interface is set for 300 baud, 7-bit words, 1 stop bit, even parity, and wait mode on. You may change any of the first four parameters to be compatible with the bar code reader. You must, however, turn off the wait mode. If you don't, Basic executes only one line at a time and expects a carriage return from the operator after each executed line.

You can change the parameters from

```
10 CLS
20 '
30 ' BAR CODE DEMONSTRATION PROGRAM #2
40 '
50 ' BATCH UPLOADING - TALK ONLY - NO CONTROL
60 '
70 CLEAR 10000
80 DIM AS (1000)
90 CMD "RS232 (WAIT=N)"
100 CMD "FORCE @KI @RS"
110 OPEN "D",1,"HOLDAT:1",8
120 FIELD 1,8 AS BS
130 CS="ENDENDEN"
140 I=0
150 I=I+1
160 INPUT AS(I)
170 IF AS(I)<>CS THEN GOTO 150
180 CMD "FORCE @KI @KI"
190 FOR J=1 TO (I-1)
200 LSET BS=AS(J)
210 PUT #1,J
220 NEXT J
230 PRINT "CLOSING FILE"
240 CLOSE
250 PRINT"RETURNING TO DOSPLUS"
260 CMD
```

Program Listing 2. Batch uploading, talk-only application.

```
10 CLS
20 '
30 ' BAR CODE DEMONSTRATION PROGRAM #3
40 '
50 ' BATCH UPLOADING - BLOCK TRANSMISSION
60 '
70 CLEAR 500
80 OPEN "D",1,"HOLDAT:1",128
90 FIELD 1,128 AS FS
100 BS=CHR$(3):TS=CHR$(4):CS=CHR$(13):SS=CHR$(32):ZS=CHR$(17)
110 CMD "RS232 (WAIT=N)"
120 PRINT"WHEN THE DISKS STOP SPINNING, TRANSMIT THE DATA"
130 CMD"FORCE @KI @RS"
140 CMD"FORCE @DO @RS"
150 DS=""
160 AS=INKEY$
170 IF AS="" THEN GOTO 160
180 IF AS=BS OR AS=TS THEN GOTO 220
190 IF AS=CS THEN AS=SS
200 DS=DS+AS
210 GOTO 160
220 LSET FS=DS
230 PUT #1
240 DS=""
250 IF AS=BS THEN PRINT ZS:GOTO 160
260 CMD"FORCE @DO @DO"
270 CLS
280 PRINT"DISPLAY RESTORED"
290 PRINT"RETURNING TO KEYBOARD CONTROL"
300 CMD"FORCE @KI @KI"
310 PRINT"CLOSING FILE"
320 CLOSE
330 PRINT"RETURNING TO DOSPLUS"
340 CMD
```

Program Listing 3. Batch uploading, block transmission application.

"The first step toward successful programming for batch data processing is the development of a data collection plan."

the operating system using the RS232 command, or while operating in Basic with the CMD"RS232" command. Remember to include WAIT = N in the list of parameters. Note that you can load these commands into JCL keyboard queue file and either invoke auto-start or access them with a single command from the keyboard.

On-Line Data Entry

When you use a bar code reader (or any peripheral device) for on-line data entry, you have to signal your Model III to expect incoming data from the RS-232C port. Do this in Basic by rerouting inputs using the Force command. This command takes the form:

FORCE normal device new device

To reroute the data from the keyboard to the RS-232C port in Basic, type:

(line number) CMD"FORCE @KI @RS"

The computer now expects subsequent Input, Input@, Inkey\$, Line Input, and Line Input@ commands from the bar code reader instead of the keyboard. Note that the display still functions normally. Don't forget to insert a Force @KI @KI before the end of the program to return control to the board.

Program Listing 1 uses two data files simultaneously. You must specify this as it loads initially in Basic. Call Basic with the suffix -F:2 (BASIC -F:2).

This program illustrates how to use bar codes in the technical library of a

TIRED?

of typing DIR: 1, COPY "FILENAME": 1 TO "FILENAME": 0, PURGE "FILENAME": 0, LIST "FILENAME": 1, LOAD "FILENAME" (F=3), PDRIVE = ... and on and on and on!

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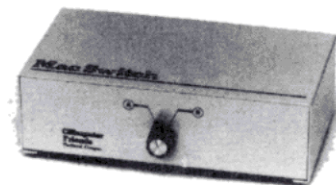
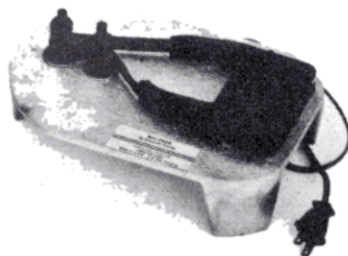
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But here on Martinicus Rock, off the coast of Maine, the power can be a tad erratic. So, to cure the brownout and blackout problems, and to keep them spikes and surges off my picture tube, I got me a **MAYDAY** Uninterruptible Power Supply from **SUN RESEARCH**. Them fellas fixed me up real good and real light on my pocketbook, too. Got me a **MAYDAY** for my mini-calcaputer with a voltage regulator and everything for only 325 clams. They even included the battery in a nice waterproof box. Handy out here, you know. Now, if **MAYDAY** would only keep them sea dogs out of my barrel. . .

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Variables	No. of Characters	Field Description
AA	50	Document Title
AB	3	Copy Number
AC	3	Current User
AD	8	Date Issued

Table 1. Data base structure.

small corporation. (You can expand it for use at the circulation desk of a small lending library.) In this application, the librarian applies bar codes to all documents and affixes bar code labels to employee ID cards. The librarian issues documents to authorized employees and uses bar codes to record the date of issue and the borrower's identification. The system uses a custom-made bar code label board for entering menu selections.

A direct-access data file (DOCDAT:1) stores the document data base. Each document receives a label with the letter D and four numbers, such as D0025 or D1014. The D signifies that the label is a document, and the four numbers represent the record number of the document in the file. Opening the file sets the logical record length to 64 characters.

Table 1 shows the structure of this data base. The first two fields, AA and AB, don't change as they identify the document. The last two fields, AC and AD, are blank until a document is issued to a user. At this time, these two fields take on the ID number of the user and the date of issue, respectively. When the

borrower returns the document, these fields revert to their original, null values. The program also records transactions on a printout. Table 2 shows a sample of the document data base.

The program stores the employee data base in a direct-access data file (USRDAT:1). Each employee's ID card has an affixed bar code label with an encoded employee number, three digits, and an authorization letter. Employee numbers begin with 101. Subtract 100 from the employee number to obtain the record number for that employee.

Table 3 shows the structure for the employee data base. The logical record length of this file is 16 characters. Table 4 shows a sample of the employee data base. Table 5 presents the list of general variables for this program.

This is but one of many on-line applications for a bar code reader and your Model III. The techniques it presents apply to almost any system that requires operator interaction from a peripheral data entry terminal device.

Batch Data Entry Device

Most bar code equipment manufac-

turers market portable bar code readers. These devices are stand-alone data collection and storage devices that you can program to prompt the operator for input in a regular sequence. This is especially useful in on-the-shelf inventory data collection and similar applications. The programmability provides the options for accepting specifically formatted data, such as set field lengths and data types for each prompt. You can also collect free-form (unprompted and unformatted) data with some of these devices.

After you collect data, you subsequently upload it into the Model III for off-line processing in an applications program. Uploading and processing take place in two distinct steps. Upload and format (if necessary) all data prior to its use in the applications program. The demonstration programs present the two general methods with which you can upload and store batch data. Your choice depends on the form of data collection and method of reader transmission to the microcomputer.

The first step toward successful programming for batch data processing is the development of a data collection plan. Remember, you can collect data in either free-form or program-prompted modes. The two scenarios that follow describe these approaches. The method of choice depends on programming for operator convenience or programming for assurance of correct data entry.

Label	Document	CPR	USR	Date
D0001	DOSPLUS VER 3.5 USER'S MANUAL	001	102	10/07/83
D0002	MIL-STD 1189:STANDARD SYMBOLOGY FOR MARKING UNIT P	001	101	07/04/83
D0003	MIL-STD 129H:MARKING FOR SHIPMENT AND STORAGE	001	101	07/04/83
D0004	80MICRO OCTOBER 83	001		
D0005	80MICRO OCTOBER 83	002		
D0006	80MICRO OCTOBER 83	003		
D0007	DBASE II USER'S MANUAL	001	102	10/07/83
D0008	STANDARD HANDBOOK FOR MECHANICAL ENGINEERS	001	105	04/14/83
D0009	STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS	001	105	04/14/83
D0010	STANDARD HANDBOOK FOR COMPUTER ENGINEERS	001		
D0011	STANDARD HANDBOOK FOR MARINE ENGINEERS	001	103	12/14/82
D0012	STANDARD HANDBOOK FOR MARINE ENGINEERS	002	109	07/17/83
D0013	STANDARD HANDBOOK FOR MARINE ENGINEERS	003	113	09/17/83
D0014	FEDERAL AVIATION REGULATIONS PART 61	001	104	12/10/82
D0015	FEDERAL AVIATION REGULATIONS PART 91	001		
D0016	FEDERAL AVIATION REGULATIONS PART 121	001		
D0017	FEDERAL AVIATION REGULATIONS PART 135	001		
D0018	CG-161	001		
D0019	CG-232	001		
D0020	CG-169	001		
D0021	TRS-80 MODEL III OPERATION AND BASIC LANGUAGE REFE	001	114	06/09/83
D0022	TRS-80 MODEL III OPERATION AND BASIC LANGUAGE REFE	002		

Table 2. Sample data base printout.

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Free-Form Data Collection

Free-form data collection is possible with some portable bar code readers. In this mode, data field length, structure, and type don't affect data collection. You can't select data validity confirmation, however. This is a useful mode for collecting different types of data in a regular but uncontrolled sequence.

For example, suppose that all the furniture in a building has a bar code label

for inventory control. Each room also has a bar code label, along with the reg-

ular room number tag, on its wall. You want to inventory each piece of furniture and its room location.

Employee #	Last Name	First Name	Auth
101	BEPLAT	RICHA	A
102	CRAFT	ROBER	A
103	CLARK	JAIV	A
104	MODER	KIM	A
105	MICHAUD	DENIS	A
106	CROW	VIRGI	A
107	SMYTHE	DONAL	B
108	JOHNSON	JANE	B
109	RICHARDS	SEAN	B
110	AUFRANC	ERNES	B
111	BJELKIER	SAM	D
112	FERGUSON	FRED	D
113	GEEBEE	MARG	C
114	WILLIAMS	JARRO	D

Table 4. Employee data base sample.

Variable	No. of Characters	Field Description
A1	10	Last Name
A2	5	First Name
A3	1	Authorization Letter

Table 3. Structure for employee data base.

You can accomplish this in the free-form mode by instructing the operator to scan the room label, then scan the label on every piece of furniture in the room, repeating this for all rooms. This is more efficient than forcing the operator to scan the room label before (or after) scanning each furniture label, or predicting the average number of items in a room and scanning the room label for every n th furniture label.

A comprehensive data collection and processing plan establishes the labeling convention so that room and furniture labels have either different scannable field lengths or unique imbedded characters or both. This is so the microcom-

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puter can distinguish between a room number and a furniture number, and format the data so the output report accurately reflects the corresponding rooms.

Programmed Data Collection

You can program all portable bar code readers to prompt the user for data entry and to accept specifically formatted data. The specific formats include data type, such as alphanumeric or numeric, and field length, which is a maximum and minimum, or exact number of scannable characters. The bar code reader accepts no data that doesn't meet the specified format, and usually re-prompts the user with an audible tone.

An example which efficiently employs programmed data collection is an on-the-shelf inventory. Each shelf has a bar code label with the stock number of the item it houses. The quantity of items ranges from zero to 99. This translates to a 1- to 2-character numeric variable. The reader prompts the users first for stock number and then quantity. The system defines each input differently. An attempt to input two of the same variable types consecutively results in an error message to the operator and a

reprompting for the correct input.

Talk-Only and Block-Transfer Batch Data Transmission

The majority of portable bar code readers transmit batch data as talk-only devices, without the benefit of handshaking routines. This means that when you force the microcomputer to perform operations it can't do in the time between transmitted characters, it loses data.

For example, the Copy command seems to be the logical choice to copy data from a device to a file. Unfortunately, the storage buffer holds only 256 characters before it writes a file. As the

microcomputer performs one function at a time, it doesn't accept input while writing to the file. Meanwhile, the bar code reader continues to transmit data, resulting in data loss.

Some portables transmit data in blocks. The operator designates the size of these blocks. The bar code reader transmits one data block at a time, talk-only, and waits for a control character from the host before it transmits the next block. This allows the microcomputer to stop listening, perform any required housekeeping operations, and signal the reader when it's ready to receive another block of data.

A control character delimits the

Variable	Purpose
R1	Number of Records in DOCDAT
R2	Number of Records in USRDAT
AT	Today's Date
A	General INKEY\$ Assignment
N	Document Record Number
M	User Record Number
I	For...Next Counter
AS	Document Record Number to String Holding Variable
AR	Reconstructed Document ID Label

Table 5. Variable list for Program 1.

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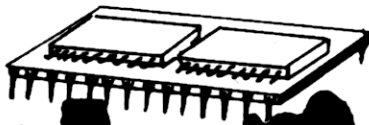
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Variable	Purpose
AS	Input Data Array
BS	File Variable
CS	End of File Check Variable
I	For...Next Counter
J	For...Next Counter

Table 6. Variables list for Program 2.

blocks and signals the host when the transmission is complete with an end-of-file marker. You can also use internal delimiters to separate data within the blocks.

As with on-line applications, the microcomputer must expect the incoming data from the RS-232C port. If the bar code reader requires control signals from the microcomputer, then you must also reroute output through the RS-232C port.

Do this the same way you reroute input, except that two possible output routings exist—to the line printer and to the display. You determine to which unit you want the output rerouted. If your system requires display prompts and status messages, then you should reroute the line printer data. If, however, you don't need the display, then

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Variable Purpose

FS	File Variable
BS	End of Block Check Variable
TS	End of File Check Variable
CS	Carriage Return Check Variable
SS	Space (Replacement for carriage return in data string)
ZS	ASCII DC1 Control Character
AS	INKEY\$ Assignment Variable
DS	Data String

Table 7. Variables list for Program 3.

you should reroute its data.

You don't need to reroute either device until you require the control signal because I/O rerouting falls under program control as often as you need it, and the bar code reader waits as long as necessary for the control signal. We recommend, however, that you reroute one device for the duration, rather than jockeying back and forth. The Force command parameters become @PR @RS for the line printer and @DO @RS for the display.

Program Listing 2 receives the entire data set from a portable bar code reader and holds it in a one-dimensional string array. Using the string "ENDENDEN" as the end of file marker sends the data in one batch. The transmitted variables are all eight characters long and delimited by a carriage return. Make the array large enough so it loads all of the data.

Because the program is small and writes the array to a disk file, you should reserve most of the memory for string space. Too much space is better than too little. This program requires input rerouting only, and utilizes the Input command for whole variable input. A direct access data file (HOLDAT:1) with a logical record length of eight characters stores the data after a complete read to the computer.

Table 6 presents the list of general variables this program uses. Note that it requires a batch of data of fewer than 1,000 entries. You can collect this free-form or programmed.

Program Listing 3 receives blocks of data from a portable bar code reader, and signals the bar code reader when the microcomputer is ready for subsequent blocks. An ASCII carriage return (CHR\$(13)) delimits data within the block although many of the available units allow the programmer to select a different delimiter if you desire.

The normal end-of-block delimiter is an ASCII ETX (CHR\$(3)) and the end-of-file delimiter is usually an ASCII EOT (CHR\$(4)). On some units these may change.

The normal signal for next block

transmission is an ASCII DC1 (CHR\$(17)). You select the number of data records to transmit in each block. Determine this number so that no character variable ends up in an overflowed condition. Also specify accordingly the logical record length of the data holding file.

The program analyzes incoming data one character at a time for delimiters and sums it to a holding variable string. It writes this string to a direct access data file (HOLDAT:1). Then it sends the control signal to the bar code reader for the next data block.

You can reformat the filed data for use in an application program, if necessary, by substring manipulation functions (such as LEFT\$, MID\$, INSTR). Table 7 represents the list of general variables the program uses.

A Final Word

You should note that this article on bar code implementation is generic in nature and assumes the reader determine present and future growth requirements for the following:

- data base size
- code formats to be read
- label length, characters encoded and quiet zones
- batch vs. on-line processing or combination
- direct connect vs. modem or combination
- data transmission modes available
- bar code reader equipment feature, options, and capability for expansion
- bar code printing capability
- environmental considerations
- off-the-shelf application software compatibility

These considerations emphasize that bar code systems are neither inexpensive nor for everyone. But if you want to improve the efficiency and integrity of TRS-80 data input, then bar codes may be for you. ■

Write Robert S. Craft and Richard G. Beplat c/o Taurio Corporation, 36 Laurelwood Road, Groton, CT 06340.



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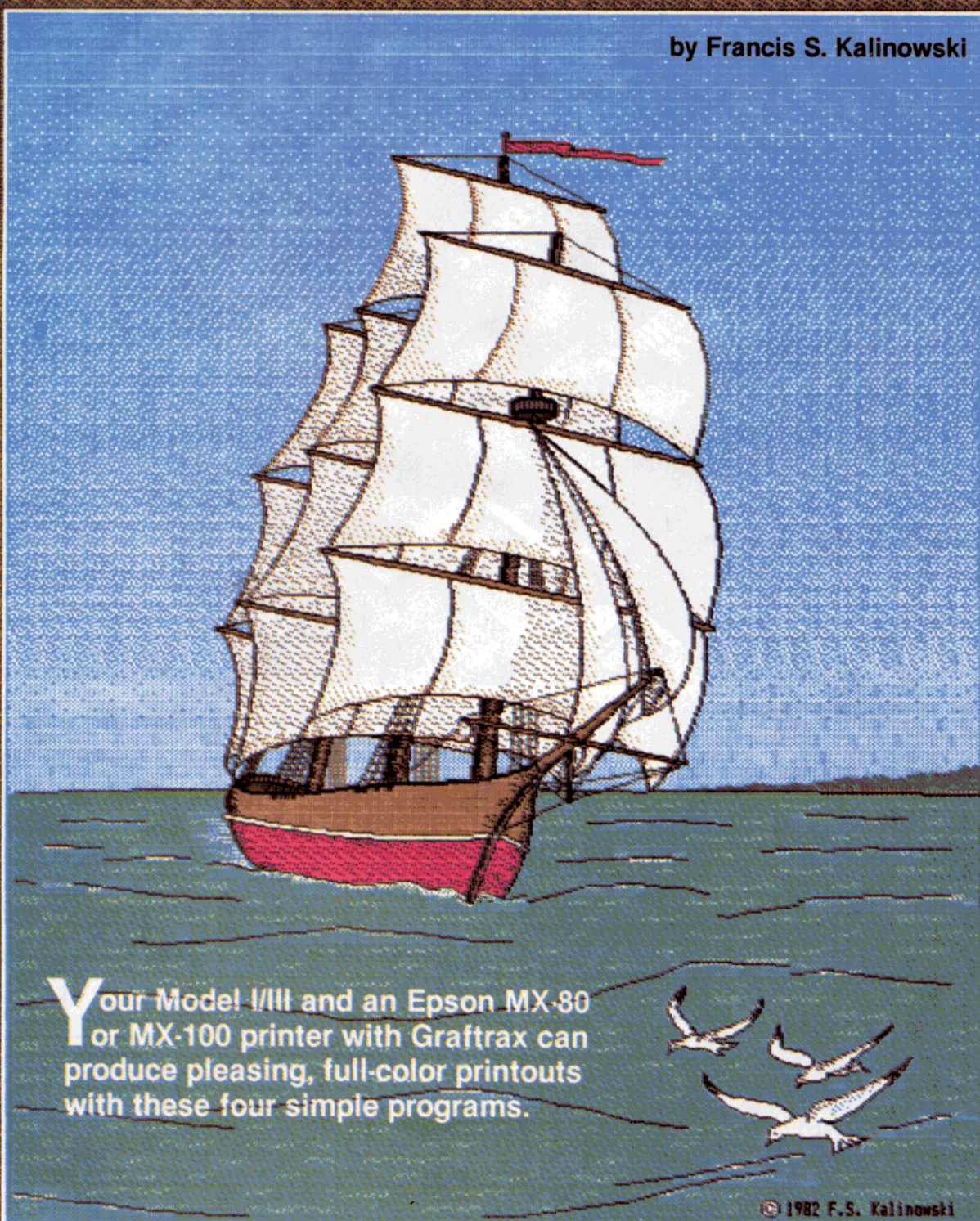
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uses 12 bytes compared to 15 bytes needed for five A1 codes with trailing semicolons.

Q- and Z-code series are assigned to blank- and full-column patterns and

pattern strings. Codes Z1-Z9 define full-column patterns 1-9 in one-column increments. ZA-ZJ codes define 10 to 100 full columns in 10-column increments. Combine Z codes to print any

quantity of full-column patterns on a print line. Codes ZJ;ZA;Z5, for example, specify a string of 115 full-column patterns. Similarly, you can combine Q (ASCII zero) codes to leave any number

SEE ***	A1	A2	A3	A4	A5	A6	A7	A8	A9	SEE ***	** MODEL	FOR 1/111	AD 13	AE 14	AF 15	AG 16	AH 17	AI 18	AJ 19	AK 20	AL 21	AM 22	AN 23	AO 24	AP 25	AQ 26	AR 27	AS 28	AT 29	AU 30	AV 31
B0 32	B1 33	B2 34	B3 35	B4 36	B5 37	B6 38	B7 39	B8 40	B9 41	BA 42	BB 43	BC 44	BD 45	BE 46	BF 47	BG 48	BH 49	BI 50	BJ 51	BK 52	BL 53	BM 54	BN 55	BO 56	BP 57	BQ 58	BR 59	BS 60	BT 61	BU 62	BV 63
C0 64	C1 65	C2 66	C3 67	C4 68	C5 69	C6 70	C7 71	C8 72	C9 73	CA 74	CB 75	CC 76	CD 77	CE 78	CF 79	CG 80	CH 81	CI 82	CJ 83	CK 84	CL 85	CM 86	CN 87	CO 88	CP 89	CQ 90	CR 91	CS 92	CT 93	CU 94	CV 95
D0 96	D1 97	D2 98	D3 99	D4 100	D5 101	D6 102	D7 103	D8 104	D9 105	DA 106	DB 107	DC 108	DD 109	DE 110	DF 111	DG 112	DH 113	DI 114	DJ 115	DK 116	DL 117	DM 118	DN 119	DO 120	DP 121	DQ 122	DR 123	DS 124	DT 125	DU 126	DV 127
E0 128	E1 129	E2 130	E3 131	E4 132	E5 133	E6 134	E7 135	E8 136	E9 137	EA 138	EB 139	EC 140	ED 141	EE 142	EF 143	EG 144	EH 145	EI 146	EJ 147	EK 148	EL 149	EM 150	EN 151	EO 152	EP 153	EQ 154	ER 155	ES 156	ET 157	EU 158	EV 159
F0 160	F1 161	F2 162	F3 163	F4 164	F5 165	F6 166	F7 167	F8 168	F9 169	FA 170	FB 171	FC 172	FD 173	FE 174	FF 175	FG 176	FH 177	FI 178	FJ 179	FK 180	FL 181	FM 182	FW 183	FO 184	FP 185	FQ 186	FR 187	FS 188	FT 189	FU 190	FV 191
G0 192	G1 193	G2 194	G3 195	G4 196	G5 197	G6 198	G7 199	G8 200	G9 201	GA 202	GB 203	GC 204	GD 205	GE 206	GF 207	GG 208	GH 209	GI 210	GJ 211	GK 212	GL 213	GM 214	GN 215	GO 216	GP 217	GQ 218	GR 219	GS 220	GT 221	GU 222	GV 223
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PRINTER CONTROL CODES

*BW = SET 960-DOT GRAPHICS

*BY = SET 480-DOT GRAPHICS

CY = RIBBON/PRINTING COLOR

DY = DOUBLE-STRIKE MODE ON

DX = DOUBLE-STRIKE MODE OFF

EY = EMPHASIZED MODE ON

EX = EMPHASIZED MODE OFF

IY = ITALIC CHARACTERS ON

IX = ITALIC CHARACTERS OFF

NY = NARROW CHARACTERS ON

NX = NARROW CHARACTERS OFF

WY = WIDE CHARACTERS ON

WX = WIDE CHARACTERS OFF

ZY = ZINGER ON (DS + EMPH)

ZX = ZINGER MODE OFF

*NOTE: CODES FOR n1 AND n2 MUST FOLLOW BW AND BY CODES.

FULL-COLUMN CHR\$(255) CODES

Z1=1 FULL COLUMN

Z2=2 Z8=8 ZE=50

Z3=3 Z9=9 ZF=60

Z4=4 ZA=10 ZG=70

Z5=5 ZB=20 ZH=80

Z6=6 ZC=30 ZI=90

Z7=7 ZD=40 ZJ=100

6-COLUMN WIDE SPACING CODES

S1=1 SPACE

S2=2 S7=7 SC=30

S3=3 S8=8 SD=40

S4=4 S9=9 SE=50

S5=5 SA=10 SF=60

S6=6 SB=20 SG=70

*****ZERO CHR\$(0) CODES**

Q1=1 ZERO QA=10

Q2=2 Q6=6 QB=20

Q3=3 Q7=7 QC=30

Q4=4 Q8=8 QD=40

Q5=5 Q9=9 QE=50

VARIABLES AVAILABLE FOR FILL-IN PROGRAM

1-LETTER STRING
A B C D E F G H I
J K L M N O P Q R S

NUMERIC
V AND V0 THRU V10
X AND X0 THRU X10
Y AND Y0 THRU Y10

**** CODES FOR MODEL 1**

AA AB AC
10 11 12

DO NOT USE THE ABOVE CODES FOR MODEL 111.

COMPLEMENTARY PATTERNS

P1  P2 

P1=CL+FA+CL+FA+CL+FA
P2=FA+CL+FA+CL+FA+CL

Figure 1. Code chart.

of blank columns before, between, or after printed column segments.

Six-column spacing (S) codes provide a faster means to jump wide gaps between printed column segments. The S codes may also be economically substituted for Tab commands at the start of an LPRINT statement. For example, S9 and TAB(9) move the print head nine spaces; but, the alphanumeric code uses only 3 bytes compared to 6 needed for TAB(9).

Bob Boothe's printer driver in the main program ("Trick Your ROM," 80 Micro, November 1982, p. 190), lets Model I users send alphanumeric Q codes (ASCII zeros) plus codes AA, AB, and AC (ASCII 10, 11, and 12) to the printer directly. No more POKes and PEEKs needed for that task. Model III users shouldn't attempt to use the AA, AB, or AC codes because AA works only occasionally, AB works unreliably, and AC invariably form-feeds the paper to the next top-of-form point. Use substitute codes in critical situations. (See the section on programming differences.)

Complementary pattern codes P1 and P2 provide 50 percent color shading. Use the patterns to combine two available colors into a third. For example, blue P2 patterns printed over red P1 patterns interweave dots to produce lavender.

Printer mode control codes perform the functions listed in Fig. 1. Escape codes are already included where needed in the two-character codes.

String and integer variables used in color art fill-in programs also appear listed in Fig. 1. Use the single-letter string variables without string declaration (\$) characters. P3-P9 and PA-PV define any length pattern string used more than once in a fill-in program.

Main Program

The main program for Grafrax color art, Program Listing 1, has three functional sections. The top section displays print/run instructions and in-progress messages, initializes the printer for each color print run, and provides useful GOSUB routines accessed from fill-in programs.

The middle section accommodates user-programmed code sequences for separate color print runs. The first part of this section allots space for user-coded GOSUB routines accessed during color print runs. Change only the middle section for different Grafrax color art printouts.

The bottom section provides code conversions for Grafrax dot-column pat-

Listing 1 continued

```

7990 GOSUB 900
7999 ' ART-DONE FLAG
8000 CY="DONE":GOSUB 35
8989 ' DISPLAY ART-DONE MESSAGE
8990 CLS:PRINT@530,"GRAFRAX COLOR ART IS DONE.":CLEAR50:END
8999 ' DISPLAY INTRODUCTION
9000 PRINTTAB(7);"E P S O N   G R A F T R A X   C O L O R   A
R T":PRINTTAB(7);STRING$(50,61):PRINT@880,"CODE END";:PRINT@962
,"** DO NOT TURN PRINTER POWER ON/OFF DURING CODING CYCLE. **";
9005 PRINT@132,"THIS PROGRAM PRINTS MULTICOLOR ART ON AN EPSON M
X-80 PRINTER WITH GRAFRAX ROMS AND INTERCHANGEABLE COLOR RIBBON
CARTRIDGES.";
9010 PRINT"      COLORS ARE PRINTED IN SEPARATE PRINT RUNS. THE P
APER MUST BE REPOSITIONED (MANUALLY BACK-FED) TO THE SAME START
POINT BEFORE";
9015 PRINT"  EACH COLOR PRINT RUN. USE START POINT INDEX MARKS ON
RIGHT-HANDEDGE OF PAPER AND ON RIGHT-HAND TRACTOR FEED MECHANIS
M.
9020 PRINT"      FOLLOW INSTRUCTIONS DISPLAYED BEFORE EACH PRINT R
UN. INITIAL INSTRUCTIONS APPEAR AFTER PATTERN CODES ARE DEFINED A
ND STORED."PRINT" ";STRING$(62,45)
9024 ' DISPLAY CODING PROGRESS STATEMENT NUMBERS
9025 PRINTSTRING$(7,92);"  C O D I N G   N O W   I N   P R O
G R E S S  ";STRING$(7,92);
9030 TRON
9049 ' DEFINE CODES FOR DOT-COLUMN PATTERNS 0 THROUGH 255
9050 Q1=CHR$(0):A1=CHR$(1):A2=CHR$(2):A3=CHR$(3):A4=CHR$(4):A5=CHR$(5):A6=CHR$(6):A7=CHR$(7):A8=CHR$(8):A9=CHR$(9):AA=CHR$(10):AB=CHR$(11):AC=CHR$(12):AD=CHR$(13):AE=CHR$(14):AF=CHR$(15)
9055 AG=CHR$(16):AH=CHR$(17):AI=CHR$(18):AJ=CHR$(19):AK=CHR$(20):AL=CHR$(21):AM=CHR$(22):AN=CHR$(23):AO=CHR$(24):AP=CHR$(25):AQ=CHR$(26):AR=CHR$(27):AS=CHR$(28):AT=CHR$(29):AU=CHR$(30):AV=CHR$(31)
9060 B0=CHR$(32):B1=CHR$(33):B2=CHR$(34):B3=CHR$(35):B4=CHR$(36):B5=CHR$(37):B6=CHR$(38):B7=CHR$(39):B8=CHR$(40):B9=CHR$(41):BA=CHR$(42):BB=CHR$(43):BC=CHR$(44):BD=CHR$(45):BE=CHR$(46):BF=CHR$(47)
9065 BG=CHR$(48):BH=CHR$(49):BI=CHR$(50):BJ=CHR$(51):BK=CHR$(52):BL=CHR$(53):BM=CHR$(54):BN=CHR$(55):BO=CHR$(56):BP=CHR$(57):BQ=CHR$(58):BR=CHR$(59):BS=CHR$(60):BT=CHR$(61):BU=CHR$(62):BV=CHR$(63)
9070 C0=CHR$(64):C1=CHR$(65):C2=CHR$(66):C3=CHR$(67):C4=CHR$(68):C5=CHR$(69):C6=CHR$(70):C7=CHR$(71):C8=CHR$(72):C9=CHR$(73):CA=CHR$(74):CB=CHR$(75):CC=CHR$(76):CD=CHR$(77):CE=CHR$(78):CF=CHR$(79)
9075 CG=CHR$(80):CH=CHR$(81):CI=CHR$(82):CJ=CHR$(83):CK=CHR$(84):CL=CHR$(85):CM=CHR$(86):CN=CHR$(87):CO=CHR$(88):CP=CHR$(89):CQ=CHR$(90):CR=CHR$(91):CS=CHR$(92):CT=CHR$(93):CU=CHR$(94):CV=CHR$(95)
9080 D0=CHR$(96):D1=CHR$(97):D2=CHR$(98):D3=CHR$(99):D4=CHR$(100):D5=CHR$(101):D6=CHR$(102):D7=CHR$(103):D8=CHR$(104):D9=CHR$(105):DA=CHR$(106):DB=CHR$(107):DC=CHR$(108):DD=CHR$(109):DE=CHR$(110):DF=CHR$(111)
9085 DG=CHR$(112):DH=CHR$(113):DI=CHR$(114):DJ=CHR$(115):DK=CHR$(116):DL=CHR$(117):DM=CHR$(118):DN=CHR$(119):DO=CHR$(120):DP=CHR$(121):DQ=CHR$(122):DR=CHR$(123):DS=CHR$(124):DT=CHR$(125):DU=CHR$(126):DV=CHR$(127)
9090 E0=CHR$(128):E1=CHR$(129):E2=CHR$(130):E3=CHR$(131):E4=CHR$(132):E5=CHR$(133):E6=CHR$(134):E7=CHR$(135):E8=CHR$(136):E9=CHR$(137):EA=CHR$(138):EB=CHR$(139):EC=CHR$(140):ED=CHR$(141):EE=CHR$(142):EF=CHR$(143)
9095 EG=CHR$(144):EH=CHR$(145):EI=CHR$(146):EJ=CHR$(147):EK=CHR$(148):EL=CHR$(149):EM=CHR$(150):EN=CHR$(151):EO=CHR$(152):EP=CHR$(153):EQ=CHR$(154):ER=CHR$(155):ES=CHR$(156):ET=CHR$(157):EU=CHR$(158):EV=CHR$(159)
9100 F0=CHR$(160):F1=CHR$(161):F2=CHR$(162):F3=CHR$(163):F4=CHR$(164):F5=CHR$(165):F6=CHR$(166):F7=CHR$(167):F8=CHR$(168):F9=CHR$(169):FA=CHR$(170):FB=CHR$(171):FC=CHR$(172):FD=CHR$(173):FE=CHR$(174):FF=CHR$(175)
9105 FG=CHR$(176):FH=CHR$(177):FI=CHR$(178):FJ=CHR$(179):FK=CHR$(180)

```

Listing 1 continued

terms, frequently used pattern groups, and printer mode control commands. This section also displays a program introduction, initial print run instructions, and equipment-used questions. Your responses to these questions initiate applicable code adjustment and/or printer driver loading routines.

The main program uses 7,967 bytes with remarks, 6,135 bytes without

"You can duplicate most of the expensive machines' output."

them. You can remove all remark statements without affecting program operation. Delete remarks between lines 9030-9145 to ensure correct sequencing

Listing 1 continued

```
(180) FL=CHR$(181):FM=CHR$(182):FW=CHR$(183):FO=CHR$(184):FP=CHR$(185):FQ=CHR$(186):FR=CHR$(187):FS=CHR$(188):FT=CHR$(189):FU=CHR$(190):FV=CHR$(191)
9110 G0=CHR$(192):G1=CHR$(193):G2=CHR$(194):G3=CHR$(195):G4=CHR$(196):G5=CHR$(197):G6=CHR$(198):G7=CHR$(199):G8=CHR$(200):G9=CHR$(201):GA=CHR$(202):GB=CHR$(203):GC=CHR$(204):GD=CHR$(205):GE=CHR$(206):GF=CHR$(207)
9115 GG=CHR$(208):GH=CHR$(209):GI=CHR$(210):GJ=CHR$(211):GK=CHR$(212):GL=CHR$(213):GM=CHR$(214):GN=CHR$(215):GO=CHR$(216):GP=CHR$(217):GQ=CHR$(218):GR=CHR$(219):GS=CHR$(220):GT=CHR$(221):GU=CHR$(222):GV=CHR$(223)
9120 H0=CHR$(224):H1=CHR$(225):H2=CHR$(226):H3=CHR$(227):H4=CHR$(228):H5=CHR$(229):H6=CHR$(230):H7=CHR$(231):H8=CHR$(232):H9=CHR$(233):HA=CHR$(234):HB=CHR$(235):HC=CHR$(236):HD=CHR$(237):HE=CHR$(238):HF=CHR$(239)
9125 HG=CHR$(240):HH=CHR$(241):HI=CHR$(242):HJ=CHR$(243):HK=CHR$(244):HL=CHR$(245):HM=CHR$(246):HN=CHR$(247):HO=CHR$(248):HP=CHR$(249):HQ=CHR$(250):HR=CHR$(251):HS=CHR$(252):HT=CHR$(253):HU=CHR$(254):ZI=CHR$(255)
9129 ' DEFINE SPACE, ZERO, AND 8-DOT COLUMN CODE STRINGS
9130 S1=CHR$(32):S2=S1+S1:S3=S2+S1:S4=S3+S1:S5=S4+S1:S6=S5+S1:S7=S6+S1:S8=S7+S1:S9=S8+S1:SA=S9+S1:SB=SA+S1:SC=SB+S1:SD=SC+S1:SE=SD+SA:SF=SE+SA:SG=SF+SA:Q2=Q1+Q1:Q3=Q2+Q1:Q4=Q3+Q1:Q5=Q4+Q1:Q6=Q5+Q1:Q7=Q6+Q1:Q8=Q7+Q1:Q9=Q8+Q1
9135 QA=Q9+Q1:QB=QA+QA:QC=QB+QA:QD=QC+QA:QE=QD+QA:Z2=Z1+Z1:Z3=Z2+Z1:Z4=Z3+Z1:Z5=Z4+Z1:Z6=Z5+Z1:Z7=Z6+Z1:Z8=Z7+Z1:Z9=Z8+Z1:ZA=Z9+Z1:ZB=ZA+ZA:ZC=ZB+ZA:ZD=ZC+ZA:ZE=ZD+ZA:ZF=ZE+ZA:ZG=ZF+ZA:ZH=ZG+ZA:ZI=ZH+ZA:ZJ=ZI+ZA:ZK=ZJ+ZJ
9139 ' DEFINE PRINTER MODE CONTROL CODES
9140 BY=AR+CB:EY=AR+C5:DY=AR+C7:NY=AR+CG:WY=AR+CJ:IY=AR+BK:LY=AR+CL+A3:ZY=EY+DY:IX=AR+BL:WX=AR+CK:NX=AR+CH:DX=AR+C8:EX=AR+C6:ZX=EX+DX:BW=AR+CC
9144 ' DISPLAY GRAFTRAX VERSION USED QUESTION
9145 TROFF:PRINT@962,"DOES YOUR PRINTER HAVE: 1. GRAFTRAX-80 OR 2. GRAFTRAX-PLUS?";
9149 ' ADJUST PRINTER MODE CODES IF GRAFTRAX-PLUS IS USED
9150 S=INKEY$:IFS="1"THEN9155ELSEIFS="2"THENCLS:NY=AF:NX=AI:WY=AE:WX=AKELSE9150
9154 ' DISPLAY TRS-80 MODEL USED QUESTION
9155 CLS:PRINT@969,"ARE YOU USING A: 1. MODEL I OR 3. MODEL III?";
9159 ' LOOP THROUGH PRINTER DRIVER ROUTINE IF MODEL I IS USED
9160 S=INKEY$:IFS="3"THEN9165ELSEIFS="1"THENCLS:PRINT@973,"NOW LOADING MODEL I PRINTER DRIVER";GOSUB9180ELSE9160
9164 ' DISPLAY FIRST PRINT RUN INSTRUCTIONS; GO TO FIRST RUN
9165 GOSUB30:PRINT" 1. VERIFY THAT PRINTER POWER IS OFF.":PRINT@258,"2. INSERT PAPER; ALIGN IT WITH FIXED INDEX MARK ON PRINTER";
9170 PRINT@386,"3. INSTALL ";CY;" RIBBON IN PRINTER.":PRINT@514,"4. TURN PRINTER POWER ON.
9175 PRINT@642,"5. PRESS THE <P> KEY TO START ";CY;" COLOR PRINT RUN.":GOTO1000
9179 ' LOAD MODEL I PRINTER DRIVER (SEE CREDIT BOX: REMS 94-96)
9180 B="21E837CB7E20FC211100397E32E837C9":V=16571
9185 FORX=1TOLLEN(B)STEP2:Y=ASC(MID$(B,X,1))-48:IFY>9THENY=Y-7
9190 T=ASC(MID$(B,X+1,1))-48:IFT>9THENT=T-7
9195 POKEV,Y*16+T:V=V+1:NEXTX:POKE16422,187:POKE16423,64:RETURN
```

of the introductory display. The display shows in-progress which statement numbers may overrun a fixed end mark if you include remark line numbers.

Initialization line 1, clear string space, defines all letters used as string variables, and identifies the first printing color. It then jumps to title and coding routines.

Lines 9000-9025 introduce the program and display general instructions for its use. A printer power on/off precaution appears at the bottom of the screen while line 9030's TRON command pops statement numbers under a coding-in-progress message.

Lines 9050-9125 define two-character codes for Grafrax dot-column patterns CHR\$(0)-CHR\$(255), while lines 9130 and 9135 define codes for various length spacing, blank-column, and full-column pattern strings. Finally, line 9140 defines abbreviated printer mode control codes for Grafrax-80.

When coding ends, line 9145 turns off the tracer function and asks for the Grafrax version you used. If it's Grafrax-Plus, line 9150 redefines the compressed and expanded character on/off codes.

Line 9155 asks whether you use a Model I or III. The Model I response displays a Loading Printer Driver message at line 9160, then loops through statements 9180-9195. The four-statement routine loads a Model I printer driver into reserved but unused RAM. (See "Trick Your ROM," *loc. cit.*)

Lines 9165-9175 display initial color print run instructions. At that point, the fill-in area line 1000 assumes display control. See the how-to section for fill-in area use and operation.

Frequently used GOSUB routines, lines 5-90, are located in the main program's top section where the program can access them faster during print runs. Remarks preceding the various routines describe their functions.

Line 90 positions the print head for easier ribbon change on an MX-80. Code BY warns the printer of dot-graphics ahead, so it responds to first code S7 and moves the print head seven spaces plus one column. S7 or TAB(7) alone won't fool the printer into moving the print head unless there's a command to execute at the end. Line 90 works only by making the print head leave a blank column after its move.

For MX-80F/T use, add SC; between the LPRINT command and spacing code S7 in line 90. The SC;S7 combination approximately centers the print head between the two plastic rollers on

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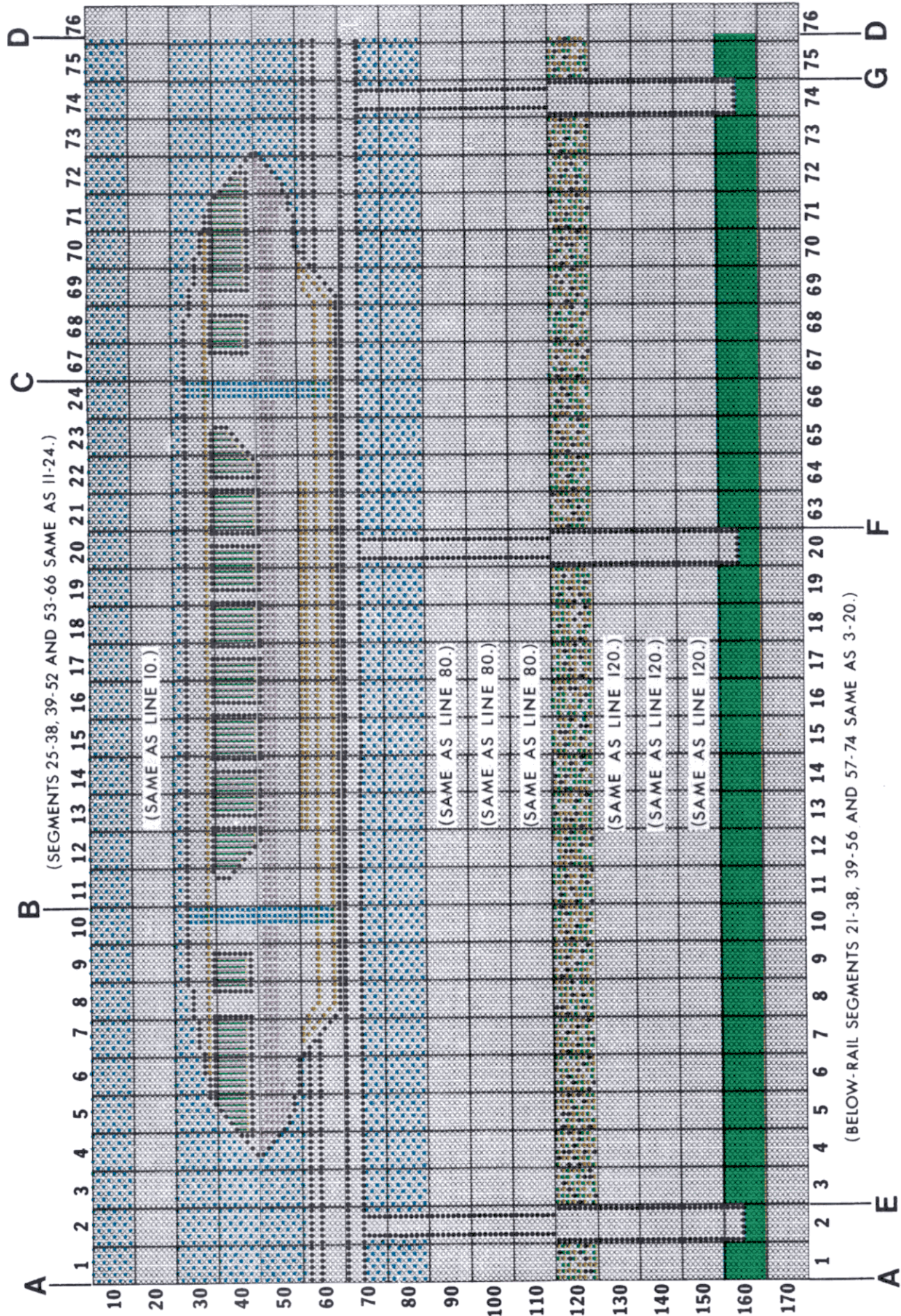


Figure 2. Monorail Train Art sketch.

the paper scale bar. Execute the main program without a fill-in program to verify displays and uncover key-in syntax errors. Save a master copy of the main program to later reload and fill in with your own color art print run routines.

A How-To Example

Figure 2 and Program Listing 2, Monorail Train Art, show how Graftrax color art evolves from an art sketch to coded fill-in program. An art subject is sketched and colored on a layout sheet having print lines eight dots high divided into blocks six columns wide. The layout arrangement simplifies column counts for initial coding and subsequent print run debugging.

I numbered print lines in increments of 10. This numbering rule allows up to 10 consecutive statement numbers for coding each print line. I program numbered a print line's six-column blocks consecutively from left to right. The blocks correspond with positions allotted for normal alphanumeric characters and spaces.

I further subdivided the art sketch in Fig. 2 into horizontal areas A-B, B-C, and C-D above the monorail's lower edge and areas A-E, E-F, F-G, and G-D below the monorail. These subdivisions allow For...To loops to repeat identical print line segments of cars, support pillars, and background.

Monorail Train Art codes and prints train-end areas A-B and C-D once for each color. It also codes upper area segment B-C and lower area segment E-F once but prints them four times for each color. Identical print lines are similarly programmed once, then repeated with GOSUBs or For...To loops as needed.

Listing 2 includes routines for six-color print runs. The listing also includes several GOSUB routines (lines 100-500) called to print identical graphics segments during color print runs. The program divides many of the print line coding sequences into three consecutively numbered statements for clarity. In most such cases you can combine the three statements into one numbered statement.

The Monorail Train fill-in program plus the main program fill 8,861 RAM bytes and clear 3,000 bytes of string space. The combined program runs on a 16K tape or 32K disk system.

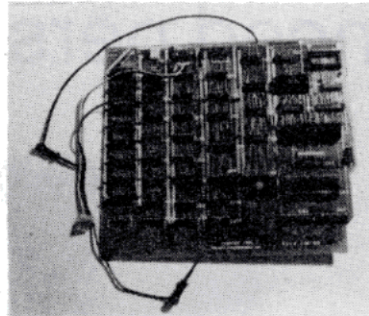
Detailed remarks precede all functional statements in Listing 2. Apostrophes identify numbered and unnumbered remarks. I indented the remarks

Continued on p. 150

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Program Listing 2. Monorail Train program.

```

94 ' @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @
    @ MONORAIL TRAIN - GRAFTRAX COLOR ART @
    @ FOR 32K LEVEL II TRS-80 MODEL I/III @
    @ AND EPSON MX-80/100 PRINTER WITH GRAFTRAX @
95 ' @ BY: FRANCIS S. KALINOWSKI @
    @ 16 N. ALDER DRIVE, ORLANDO, FL 32807 @
    @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @

97 ' NOTE: ADD STATEMENTS 1-90 OF PROGRAM LISTING 1.
99 ' SPACE 1-4, SET 480-MODE FOR 405 COLUMNS, PRINT WINDOW PANES
    IN 5-10 TO B.
100 LPRINT$4;BY;EL;AL;AE;AS;BS;DS;STRING$(14,252)Q5;STRING$(5,25
2)Q8;
    ' PRINT SEGMENT B TO C WINDOW PANES FOUR TIMES.
101 FORU=1TO4:LPRINTQ5;H0;HG;HO;HS;HU;Z2;Q3;Z6;Q3;Z6;Q3;Z6;Q3;Z6;
;Q3;Z6;Q3;Z6;Q3;Z2;HU;HS;HO;HG;H0;Q8;:NEXT
    ' PRINT WINDOW PANES IN 67-74 PLUS THREE COLUMNS.
102 LPRINTQ5;STRING$(5,252)Q5;STRING$(14,252)DS;BS;AS;AE;RETURN
299 ' SET 480-MODE FOR 451 COLUMNS, LOOP TO PRINT 75 SIX-COLUMN
    PATTERNS PLUS ONE COLUMN FROM A TO D.
300 LPRINTBY;G3;A1;:GOSUB15:LPRINTCL:RETURN
309 ' FROM B, SPACE 11-23, SET 480-MODE FOR SIX COLUMNS, PRINT
    THREE BLANK AND THREE FULL COLUMNS TO C. DO THIS FOUR
    TIMES.
310 FORU=1TO4:LPRINTSA;S3;BY;A6;Q4;Z3;:NEXT:RETURN
319 ' SET 480-MODE FOR 451 COLUMNS, PRINT SKY AND SUPPORT
    PILLAR (BLANK) FROM A TO E, ZERO VARIABLE X.
320 LPRINTBY;G3;A1;P;CL;Q4;FA;:X=0
    ' LOOP TO PRINT 17 SIX-COLUMN PATTERNS FROM E, THEN PRINT
    SUPPORT PILLAR (BLANK) IN 20 ENDING AT F. DO THIS FOUR
    TIMES ENDING AT G, THEN PRINT SKY FROM G TO D.
321 GOSUB15:LPRINTCL;Q4;FA;:X=X+1:IFX<4THEN321ELSELPRINTP;CL:RET
URN
399 ' SET 480-MODE FOR 451 COLUMNS, LOOP TO PRINT SIX RANDOM
    COLUMN PATTERNS FROM A, PRINT 6 BLANK COLUMNS TO E,
    ZERO X, DEFINE T.
400 T=6:LPRINTBY;G3;A1;:GOSUB20:LPRINTQ6;:X=0:T=102
    ' FROM E, LOOP TO PRINT 102 RANDOM COLUMN PATTERNS THEN six
    BLANK COLUMNS TO F. DO THIS FOUR TIMES, ENDING AT G, THEN
    LOOP TO PRINT SEVEN RANDOM COLUMN PATTERNS FROM G TO D.
401 GOSUB20:LPRINTQ6;:X=X+1:IFX<4THEN401ELSESET=6:GOTO25
499 ' SPACE 1, SET 480-MODE FOR SIX COLUMNS, PRINT P PATTERN
    IN 2. SPACE 3-19, PRINT P PATTERN IN 20 TO F. DO THIS
    FOUR TIMES TO POINT G.
500 LPRINT$1;BY;A6;Q1;P;:FORU=1TO4:LPRINTSA;S7;BY;A6;Q1;P;:NEXT:
LPRINT:RETURN
999 ' DEFINE CY, LOOP FOR START INSTRUCTION AND INITIALIZATION
    OF PRINTER, DEFINE T, LOOP TO DO THREE LINEFEEDS.
1000 CY="RED":GOSUB70:T=3:GOSUB10
1039 ' PRINT TRAIN'S WINDOW PANES RED. (SEE 100, 101, AND 102.)
1040 GOSUB100
1049 ' SPACE 1-3, SET 480-MODE FOR 42 COLUMNS, PRINT 4-10 TO B.
1050 LPRINT$3;BY;BA;Q4;E0;G0;H0;HG;HO;DO;DS;DO;DO;DO;DO;STRING$(
25,112)Q3;
    ' SET 480-MODE FOR 84 COLUMNS, PRINT SEGMENT B TO C. DO
    THIS FOUR TIMES.
1051 FORU=1TO4:LPRINTBY;CK;Q1;STRING$(81,112)Q3;:NEXT
    ' SET 480-MODE FOR 36 COLUMNS, PRINT 67-72.
1052 LPRINTBY;B4;Q1;STRING$(25,112)DO;DO;DO;DS;DS;DO;HO;HG;H0;G0
;E0
1089 ' LOOP TO MOVE PRINthead FOR RIBBON CHANGE.
1090 GOSUB90
1099 ' DEFINE CY, LOOP FOR INSTRUCTIONS AND INITIALIZATION OF
    PRINTER, LOOP TO DO TWO LINEFEEDS.
2000 CY="BROWN":GOSUB35:GOSUB5
2029 ' SPACE 1-5, SET 480-MODE FOR 390 COLUMNS, PRINT 6-70, LOOP
    TO DO TWO LINEFEEDS.
2030 LPRINT$5;BY;E6;A1;STRING$(195,2)STRING$(195,2):GOSUB5
2059 ' SPACE 1-6, SET 480-MODE FOR 24 COLUMNS, PRINT 7-10 TO B.
2060 LPRINT$6;BY;AO;Q3;E0;G0;F0;EG;C8;B4;STRING$(16,18);

```

Listing continued

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to distinguish them from functional statements. Each remark tells what the statement directly below it does. Delete all remarks when keying in the program.

Letters A-G in the remarks identify start and end point letters on art sketch Fig. 2. Unless otherwise noted, one- and two-digit numbers identify the six-column blocks on Fig. 2 print lines. Hyphens between two such numbers denote through. For example, 1-10 means blocks 1 through 10.

Loop means branch through one or

more GOSUB routines and return.

Set mode for a quantity of columns requires three codes. The codes activate the printer's Grafrax mode for a specified number of eight-dot columns. First code BY or BW sets a 480 or 960 mode. Second and third codes represent n1 and n2 values; both must follow a BY or BW code. The second code (obtained from Fig. 1) specifies a number of columns up to 255. The third code specifies a number of columns in 256-column increments. This code may be Q1 for zero columns, A1 for 256, A2 for 512, and A3 for 768. A2 and A3 codes may be

used only in 960 mode. See p. 7 in the Grafrax-80 manual or appendix p. B-2 in the Grafrax-Plus manual for instructions on determining n1 (second code) and n2 (third code) values.

The program redefines integer variable T and string variable P and uses them throughout the program. T's numeric value denotes the number of times a function should repeat in a GOSUB routine's For...To loop. T specifies a number of line feeds at the start of most color print runs. T is subsequently redefined to specify any quantity of P-pattern strings or random-pattern columns it prints on a line.

String variable P normally represents a six-column pattern string like P1 or P2 (see Fig. 1). You may redefine P to represent any length mixed-pattern string used more than once on a print line.

The best way to see how the program codes color print runs is to compare art sketch lines with corresponding print line statements in Listing 2. Add a print run's first line number to Fig. 2's print line numbers to identify matching LPRINT statements. See Fig. 1 to identify the various two-character codes used in the statements.

Trace each print run's functional statements in turn. Divert through every GOSUB to see what the routine does and how. Along the way, verify a few dot-graphics codes by checking their patterns (Fig. 1) against corresponding print run colored column patterns in the art sketch (Fig. 2).

Print Run Descriptions

Fill-in program execution starts at line 1000. String variable CY defines the ribbon color used for the run. CY appears as the ribbon color in displayed instructions and in Now Printing Color messages. GOSUB70 loops through the main program's print-start routines in 70, 80, and 85. T specifies a quantity of three, and GOSUB10 advances the paper three lines.

Line 1040 loops through statements 100, 101, and 102 to print the train's windows red for later overprint with green. Code S4 in statement 100 moves the print head four spaces. Codes BY;EL;A1 set the 480-dot graphics mode for 405 columns. The n1;n2 codes (EL;A1) are derived using $405 - 256 = 149$, wherein EL represents 149 and A1 represents 256. The statement's remaining codes print the left-end train windows in line 40. Last, code Q8 moves the print head eight blank columns to point B (see Fig. 2).

Line 101 prints four sets of car windows exactly like those shown between

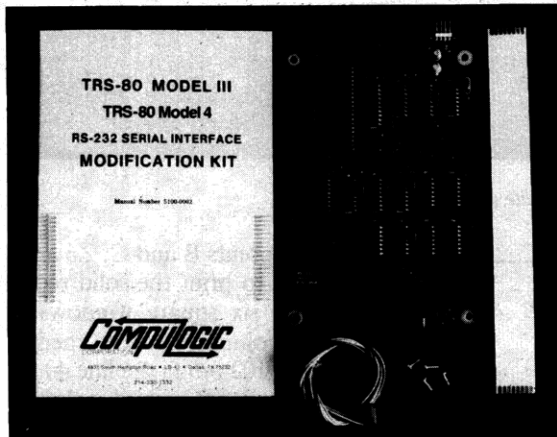
Listing 2 continued

```
' SET 480-MODE FOR 84 COLUMNS, PRINT B TO C. DO THIS FOUR
TIMES.
2061 FORT=1TO4:LPRINTBY;CK;Q1;STRING$(12,18)STRING$(56,210)STRIN
G$(16,18);:NEXT
' SET 480-MODE FOR 19 COLUMNS, PRINT 67-69 PLUS ONE COLUMN.
2062 LPRINTBY;AJ;Q1;STRING$(13,18)B4;C8;EG;F0;G0;E0
2069 ' DEFINE T, LOOP TO DO FIVE LINEFEEDS.
2070 T=5:GOSUB10
2119 ' LOOP FOUR TIMES TO PRINT LINES 120, 130, 140, AND 150
FROM A TO D. (SEE 400 AND 401.)
2120 FORT=1TO4:GOSUB400:NEXTY
2989 ' LOOP TO MOVE PRINTHEAD FOR RIBBON CHANGE.
2990 GOSUB90
2999 ' DEFINE CY, LOOP FOR INSTRUCTIONS AND INITIALIZATION OF
PRINTER, DEFINE P PATTERN. (SEE PATTERN P1 IN FIG. 1.)
3000 CY="BLUE":GOSUB35:P=P1
3009 ' DEFINE T, LOOP TWICE TO PRINT SKY ON LINES 10 AND 20.
(SEE 300.)
3010 T=75:GOSUB300:GOSUB300
3029 ' DEFINE P PATTERN, SET 480-MODE FOR 451 COLUMNS, PRINT
A TO B, ZERO X, DEFINE T.
3030 P=C0+F0+C0+F0+C0+F0:LPRINTBY;G3;A1;P1;P1;P1;P1;P1;CK;FA;CK;
F9;CK;F8;CK;F8;CG;F8;CG;F8;P;P;C0;F0;C0;FV;DV;FV;:X=0:T=13
' LOOP TO PRINT 13 P-PATTERNS PLUS SIX COLUMNS FROM
B TO C. DO THIS FOUR TIMES.
3031 GOSUB15:LPRINTC0;F0;C0;FV;DV;FV;:X=X+1:IFX<4THEN3031
' PRINT P AND P1 PATTERNS AND SINGLE COLUMNS FROM C TO D.
3032 LPRINTP;P;CG;F0;CG;F8;CG;F8;CG;F8;CK;F8;CK;F8;P1;P1;P1;P1;
P1;CL
3039 ' SET 480-MODE FOR 60 COLUMNS, PRINT FROM A TO B.
3040 LPRINTBY;BS;Q1;P1;P1;P1;CL;FA;CL;FA;CK;F8;CG;F0;C0;E0;QB;Q9
;Z3;
' LOOP TO PRINT SEGMENT B TO C FOUR TIMES. (SEE 310.)
3041 GOSUB310
' SPACE 67-71, SET 480-MODE FOR 25 COLUMNS, PRINT 72-75
PLUS ONE COLUMN.
3042 LPRINTS5;BY;AP;Q1;C0;F0;CG;F8;CK;FA;P1;P1;P1;CL
3049 ' SET 480-MODE FOR 60 COLUMNS, PRINT FROM A TO B.
3050 LPRINTBY;BS;Q1;P1;P1;P1;CL;FA;CL;BA;AL;AQ;A5;A2;A1;A2;A1;A2
;QB;Q7;Z3;
' LOOP TO PRINT SEGMENT B TO C FOUR TIMES. (SEE 310.)
3051 GOSUB310
' SPACE 67-70, SET 480-MODE FOR 31 COLUMNS, PRINT 71-75
PLUS ONE COLUMN.
3052 LPRINTS4;BY;AV;Q5;A1;A2;A5;A2;A5;AQ;AL;BA;P1;P1;P1;CL
3059 ' DEFINE P PATTERN, SET 480-MODE FOR 60 COLUMNS, PRINT FROM
A TO B.
3060 P=Q1+E0+Q1+E0+Q1+E0:LPRINTBY;BS;Q1;P;P;P;P;P;P;QB;Q1;Z3;
' LOOP TO PRINT SEGMENT B TO C FOUR TIMES.
3061 GOSUB310
' SET 480-MODE FOR 54 COLUMNS, FROM C PRINT 21 BLANK
THEN 33 COLORED COLUMNS TO D.
```

Listing 2 continued

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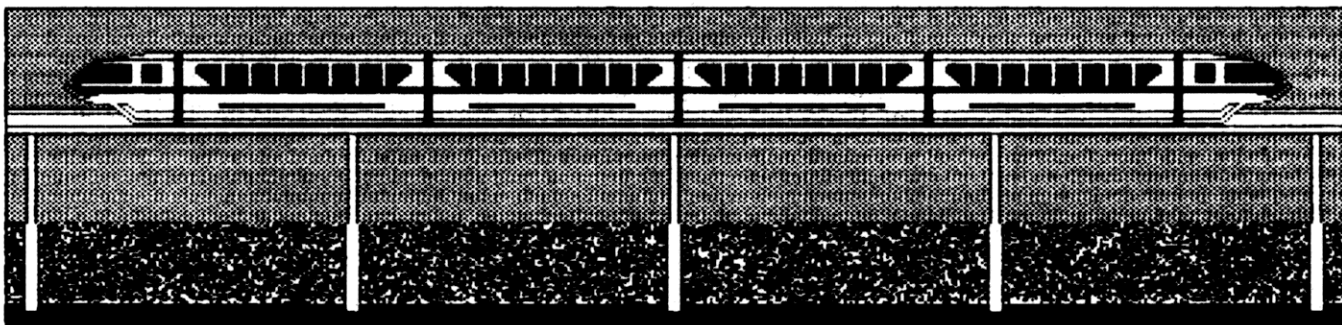


Figure 3. Monorail Train black/white art.

Listing 2 continued

```

3062 LPRINTBY;BM;QB;Q2;E0;Q1;E0;P;P;P;P;P
3069 ' DEFINE P PATTERN, SET 480-MODE FOR 451 COLUMNS, PRINT
      FROM A TO E, ZERO X, DEFINE T.
3070 P=AL+AQ+AL+AQ+AL+AQ:LPRINTBY;G3;A1;P;AL;Q4;AQ;:X=0:T=17
      ' LOOP TO PRINT 17 P-PATTERNS AND SIX COLUMNS FROM B TO C.
      DO THIS FOUR TIMES.
3071 GOSUB15:LPRINTAL;Q4;AQ;:X=X+1:IFX<4THEN3071
      ' PRINT SEVEN COLORED COLUMNS FROM G TO D.
3072 LPRINTP;AL
3079 ' DEFINE P PATTERN, DEFINE T, LOOP FOUR TIMES TO PRINT
      LINES 80, 90, 100, AND 110. (SEE 320 AND 321.)
3080 P=PL:T=17:FOR Y=1TO4:GOSUB32:NEXT Y
3989 ' LOOP TO MOVE PRINTHEAD FOR RIBBON CHANGE.
3990 GOSUB90
3999 ' DEFINE CY, LOOP FOR INSTRUCTIONS AND INITIALIZATION OF
      PRINTER, DEFINE T, LOOP TO DO THREE LINEFEEDS.
4000 CY="GREEN":GOSUB35:T=3:GOSUB10
4039 ' LOOP TO OVERPRINT TRAIN'S RED WINDOW PANES WITH GREEN TO
      MAKE THEM A DEEP BROWN. (SEE 100, 101, AND 102.)
4040 GOSUB100
4049 ' DEFINE T, LOOP TO DO SEVEN LINEFEEDS.
4050 T=7:GOSUB10
4119 ' LOOP FOUR TIMES TO OVERPRINT BROWN RANDOM-PATTERNED
      LINES 120, 130, 140, AND 150 WITH GREEN PATTERNS.
      (SEE 400, 401, 402.)
4120 FOR Y=1TO4:GOSUB400:NEXT Y
4159 ' SET 960-MODE FOR 902 COLUMNS, PRINT FROM A TO E.
4160 LPRINTBW;E6;A3;Z4;Z2;STRING$(12,15);
      ' PRINT SEGMENT E TO F FOUR TIMES, ENDING AT POINT G
4161 FOR U=1TO4:LPRINTZJ;ZJ;Z4;STRING$(12,15);:NEXT
      ' PRINT 14 DOUBLE-DENSITY GREEN COLUMNS FROM G TO D.
4162 LPRINTZA;Z3;HF
4989 ' LOOP TO MOVE PRINTHEAD FOR RIBBON CHANGE.
4990 GOSUB90
4999 ' DEFINE CY, LOOP FOR INSTRUCTIONS AND INITIALIZATION OF
      PRINTER, LOOP TO DO TWO LINEFEEDS.
5000 CY="BLACK":GOSUB35:GOSUB5
5029 ' SPACE 1-4, SET 480-MODE FOR 401 COLUMNS, PRINT 5-10
      TO B, ZERO X.
5030 LPRINTS4;BY;EH;A1;Q4;A1;A1;A3;A3;A3;A5;A5;A5;A5;STRING$(5,9)
      )AH;AG;AG;AG;AH;STRING$(6,33)STRING$(7,32);:X=0
      ' PRINT SEGMENT B TO C FOUR TIMES.
5031 LPRINTSTRING$(5,32);:FOR U=1TO8:LPRINTSTRING$(8,33)B0;:NEXT:
      LPRINTSTRING$(7,32);:X=X+1:IFX<4THEN5031
      ' FROM POINT C, PRINT 67-70 PLUS THREE COLUMNS.
5032 LPRINTB0;B0;B0;B0;STRING$(6,33)AH;AG;AG;AG;AH;STRING$(5,9)A
      5;A5;A5;A5;A3;A3;A1;A1
5039 ' SPACE 1-3, SET 480-MODE FOR 415 COLUMNS, PRINT 4-10,
      ZERO X.
5040 LPRINTS3;BY;EV;A1;Q2;A1;A2;A4;AE;AI;B2;C2;E2;STRING$(14,2)H
      U;Q3;HU;STRING$(5,2)HU;Q7;:X=0
      ' PRINT WINDOW SIDES IN SEGMENT B TO C. DO THIS FOUR TIMES.
5041 LPRINTQ4;H0;AG;A8;A4;A2;A1;Q2;Z1;Q1;:FOR U=1TO6:LPRINTZ1;Q6;
      Z1;Q1;:NEXT:LPRINTZ1;Q2;A1;A2;A4;A8;AG;H0;Q7;:X=X+1:IFX<4THEN504
      1

```

Listing 2 continued

print line 40 points B and C. Z6 and Q3 codes repeat to print the solid red portions of the six square windows with three blank columns between them.

Statement 102 prints the line 40 right-end windows to the third column of block 72. First code Q5 moves the print head five blank columns from point C to the first printing column for STRING\$(5,242).

Lines 1050, 1051, and 1052 print a line 50 red stripe on the train's left end, four cars, and right end, respectively. S3 in statement 1050 moves the print head three six-column spaces. BY;BA;Q4 set the 480-dot graphics mode and move the print head three blank columns.

In this case, BA denotes 42 columns; the first zero of Q4 denotes add zero columns to 42; the last three zeros of Q4 do three blank columns. The rest of the codes in line 1050 print the left-end part of the red stripe to the center of character block 10. Last code Q3 moves the print head to point B, leaving three blank columns to be printed later in solid blue.

Line 1051 prints an 81-column long red stripe plus three blank columns four times. BY;CK;Q1 set the 480-dot graphics mode for 84 columns plus zero columns during each iteration of the statement's For...To loop.

Line 1052 prints the red stripe's right end across line 50's character blocks 67 through 72. BY;B4;Q1 codes set the 480-dot graphics mode for 36 columns. The remaining codes print the columns.

The loop in line 1990 calls line 90 to move the print head to the right seven spaces for ribbon cartridge change.

Brown print/run line 2000 loops through main program routines at lines 35-85, then lines 5-10. The first statement group displays new instructions, redefines P1 and P2 patterns, and reinitializes the printer for Grafrax line spacing. The latter statement pair advances the paper two print lines. Subsequent statements print lines 30 and 60, then advance the paper five lines.

Line 2120 loops through the full-line

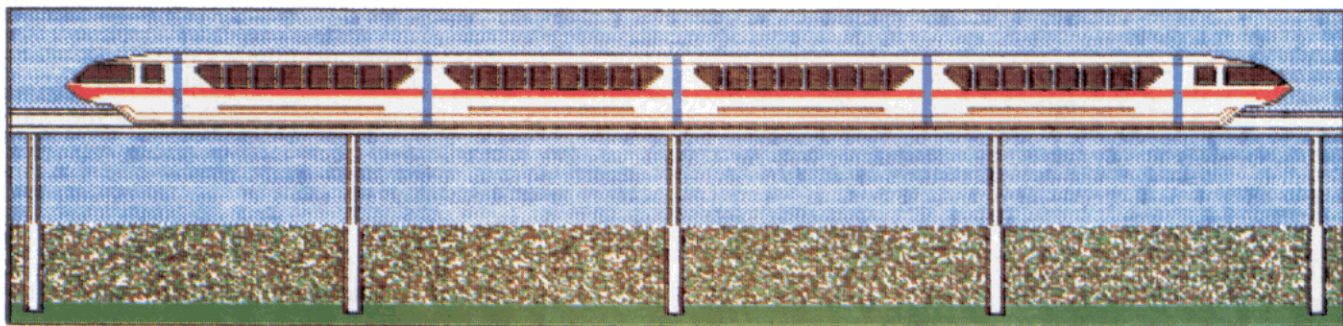


Figure 4. Monorail Train five-color art.

printing routine at lines 400 and 401 to print four identical background lines. The code BY;G3;A1 in line 400 sets 480-dot graphics for the 451 columns between points A and D. A loop through main program line 20 starts line 120 by printing six random pattern columns. Code Q6 moves the print head six blank columns to point E. The semicolon after Q6 holds the print head at point E while variable X is zeroed and T is assigned a value of 102.

Line 401 prints four 102-column E to F segments, ending at point G, then prints seven more columns to point D. The statement first loops through line 20 to print 102 random column patterns, moves the print head six blank columns with Q6, then increments X by 1. This cycle repeats until X equals 4. At that point, T is assigned a quantity of six, and a jump to statement 25 prints the seven random column patterns between points G and D.

Figure 3 shows a black and white printout from the Monorail Train Art program, using a black ribbon for all color print runs. (Figure 4 shows a five-color result of the same program.) If you don't plan to get colored ribbons, try your hand at programming black and white art for a single black print run. You can even use P1 or P2 patterns (see Fig. 1) to achieve gray shading in single-run art printouts.

Printing Grafrax Art

Grafrax color art requires a separate print run for each color. The paper's start point, established for the first print run, must be exactly the same for the remaining print runs. Use 20-pound white bond paper.

Paper edge and fixed index marks provide a fairly accurate means to reposition the paper between print runs. Establish index marks as follows:

- Feed the paper into the printer, and engage its pinfeed holes with the pins of both tractor feed mechanisms.
- Lock the right-hand feed mechanism. Leave the left-hand mechanism un-

Listing 2 continued

```
' PRINT 67-72 PLUS ONE COLUMN.
5042 LPRINTQ4;HU;STRING$(5,2)HU;Q3;HU;STRING$(14,2)E2;C2;B2;A1;A
E;A4;A2;A1
5049 ' SPACE 1-3, SET 480-MODE FOR 18 COLUMNS, PRINT 4-6, SPACE
7-10 TO B, ZERO X.
5050 LPRINTS3;BY;A1;Q3;E0;C0;B0;AG;A8;A4;A4;A2;A2;A2;STRING$(6,1
)S4;:X=0
' SET 480-MODE FOR 84 COLUMNS, PRINT SEGMENT B TO C.
DO THIS FOUR TIMES.
5051 LPRINTBY;CK;Q1;QA;E0;E0;E0;Q1;:FORU=1TO6:LPRINTSTRING$(8,12
3)Q1;:NEXT:LPRINTQ0;E0;E0;QA;Q3;:X=X+1:IFX<4THEN5051
' SPACE 67-69, SET 480-MODE FOR 19 COLUMNS, PRINT 70-72
PLUS ONE COLUMN.
5052 LPRINTS3;BY;AJ;Q4;STRING$(6,1)A2;A2;A2;A4;A4;A8;AG;B0;C0;E0
5059 ' SET 480-MODE FOR 451 COLUMNS, PRINT LINE 60 FROM A TO D.
5060 LPRINTBY;G3;A1;STRING$(36,80)GG;CG;BG;AG;A8;A4;A2;STRING$(1
7,1)STRING$(168,1)STRING$(168,1)STRING$(14,1)A2;A4;A8;AG;BG;CG;G
G;STRING$(34,80)
5069 ' SET 480-MODE FOR 451 COLUMNS, PRINT FROM A TO E.
5070 LPRINTBY;G3;A1;STRING$(7,144)EV;EG;EG;EV;
' PRINT SEGMENT E TO F FOUR TIMES, ENDING AT POINT G.
5071 FORU=1TO4:LPRINTSTRING$(104,144)EV;EG;EG;EV;:NEXT
' PRINT FROM G TO D.
5072 LPRINTSTRING$(8,144)
5079 ' DEFINE P PATTERN, LOOP FOUR TIMES TO PRINT IDENTICAL
LINES 80, 90, 100, AND 110. (SEE 500.)
5080 P=Q1+Z1+Q2+Z1+Q1:FORX=1TO4:GOSUB500:NEXTX
5119 ' DEFINE P PATTERN, LOOP FOUR TIMES TO PRINT IDENTICAL
LINES 120, 130, 140, AND 150. (SEE 500.)
5120 P=Z1+Q4+Z1:FORX=1TO4:GOSUB500:NEXTX
5159 ' DEFINE P PATTERN, LOOP TO PRINT LINE 160. (SEE 500.)
5160 P=HG+AG+AG+AG+AG+HG:GOSUB500
5989 ' LOOP TO MOVE PRINTHEAD FOR RIBBON CHANGE.
5990 GOSUB90
5999 ' DEFINE CY, LOOP FOR INSTRUCTIONS AND INITIALIZATION OF
PRINTER.
6000 CY="BORDER":GOSUB35
6009 ' SET 480-MODE FOR 451 COLUMNS, PRINT TOP-EDGE BORDER
FROM A TO D.
6010 LPRINTBY;G3;A1;Z1;STRING$(224,128)STRING$(225,128)Z1
6019 ' SET 480-MODE FOR SIX COLUMNS, PRINT ONE FULL AND THREE
BLANK COLUMNS, SPACE 2-75, SET 480-MODE FOR ONE COLUMN,
PRINT FIRST COLUMN OF 76. DO THIS 15 TIMES TO PRINT
LEFT AND RIGHT EDGE BORDERS.
6020 FORU=1TO15:LPRINTBY;A6;Q1;Z1;Q5;SG;S4;BY;A1;Q1;Z1:NEXT
6169 ' SET 480-MODE FOR 451 COLUMNS, PRINT BOTTOM-EDGE BORDER
FROM A TO D.
6170 LPRINTBY;G3;A1;STRING$(225,128)STRING$(226,128)
6989 ' LOOP TO MOVE PRINTHEAD FOR RIBBON CHANGE.
6990 GOSUB90
7999 ' ASSIGN "DONE" TO CY, LOOP THROUGH DONE-FLAG DETECT
STATEMENT 35 TO ART-DONE MESSAGE DISPLAY STATEMENT
8990 OF MAIN PROGRAM.
8000 CY="DONE":GOSUB35
8009 ' NOTE: ADD STATEMENTS 8990-9195 OF PROGRAM LISTING 1.
```


Program Listing 3. Bird of Prey program.

[illegible]

Listing 3 continued on p. 158

locked to minimize paper buckling during dense color print runs.

- Using the printer's paper feed knob, advance the paper until the first fanfold crease moves up slightly past the print head.

● Attach a short strip of white sticky-black label to the outer rear surface area on top of the right-hand feed mechanism. Position the label strip with its left-hand edge right next to the printer paper's right-hand edge.

- Using a fine-point pencil, draw a short straight index line across the paper's edge and the fixed label strip. The two resulting marks are paper repositioning indexes for subsequent color print runs.

Load and start the Grafrax color art program. Displayed instructions tell you what to do in a specific order. The last instruction tells you to press the P key to start the first color print run.

Instructions to turn printer power off, reposition paper, insert slipsheet, change ribbon, remove slipsheet, align index marks, turn printer power on, and start the next print run appear after each print run. Follow all instructions exactly and in the given order.

The instructions may display long before a print run ends if you use a serial interface with a large character buffer. In this case, allow enough time for the print run before complying with instructions. Play it safe by adding code A7 after LPRINT in line 90. Code A7 gives you a 1/3-second beep tone when a print run ends. You must set the printer's internal DIP (dual in-line package) switch SW1-6 to on for beeper operation.

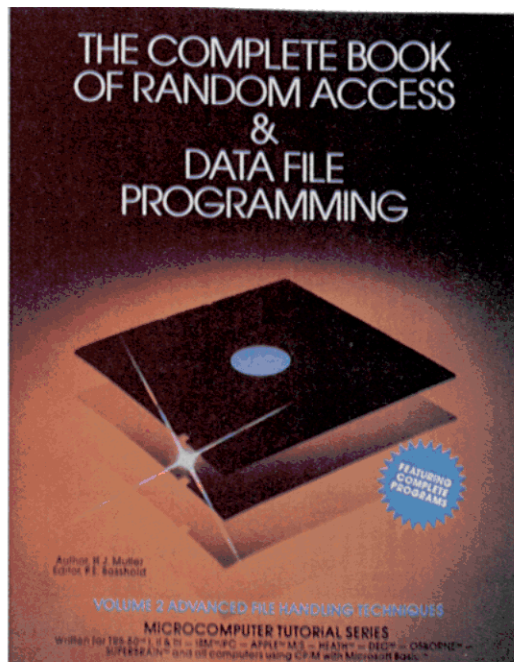
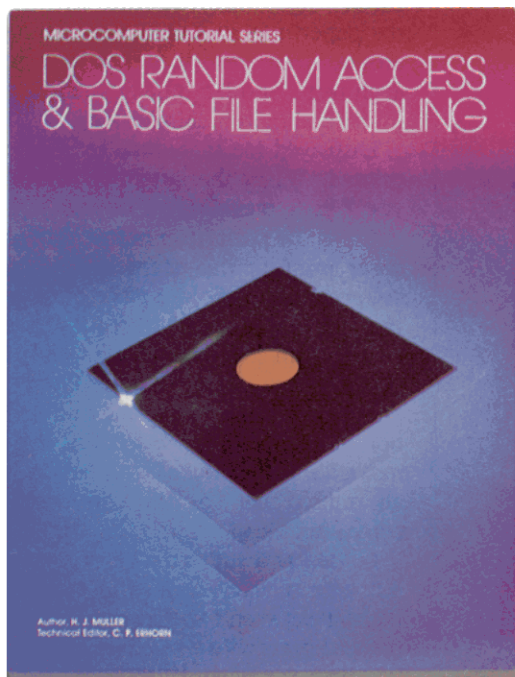
When instructed, rewind the paper by carefully backfeeding it with the paper feed knob while gently pulling straight back on the paper's trailing end. Use just enough rearward pull to eliminate paper slack in the print head area. Continue backfeeding in this manner until the paper's index mark moves at least 1/2 inch past the fixed index mark.

The slipsheet mentioned in the instructions can be any thin piece of paper about 4 inches square. A slipsheet inserted between the art paper and print head ribbon guide prevents accidental color smudging during ribbon cartridge change.

When instructed, carefully advance the paper until its index mark is within 1/4 inch of the fixed index mark. Stop at that point, grasp input part of paper at both edges just behind the paper separator, and pull it straight back slightly. Now, carefully and slowly advance the paper to exactly align its index mark

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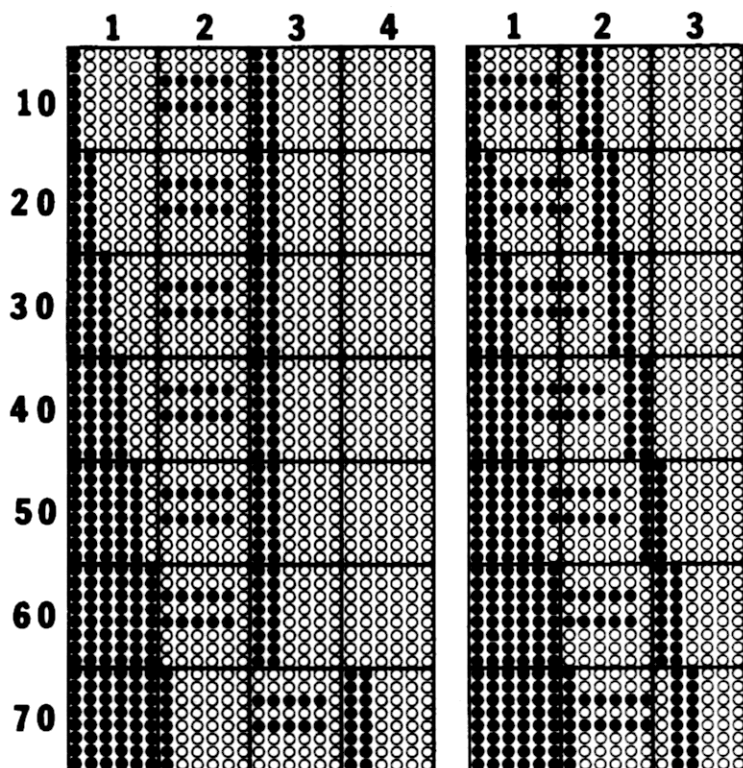
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GRAFTRAX-80

GRAFTRAX-PLUS



Spacing Test Fill-in Program

```
1010 LPRINTBY;A1;Q1;Z1;BT;BY;A2;Q1;Z2
1020 LPRINTBY;A2;Q1;Z2;BT;BY;A2;Q1;Z2
1030 LPRINTBY;A3;Q1;Z3;BT;BY;A2;Q1;Z2
1040 LPRINTBY;A4;Q1;Z4;BT;BY;A2;Q1;Z2
1050 LPRINTBY;A5;Q1;Z5;BT;BY;A2;Q1;Z2
1060 LPRINTBY;A6;Q1;Z6;BT;BY;A2;Q1;Z2
1070 LPRINTBY;A7;Q1;Z7;BT;BY;A2;Q1;Z2
```

Note: Code BT is used instead of S! (Space) to print the equals sign for clarity.

Figure 5. Grafrax spacing characteristics.

with the fixed index mark. If you pass the fixed mark even slightly, backfeed the paper about 1/2 inch (don't forget the gentle backward pull) and try aligning the index marks again.

Don't pull on or move any part of the paper during a color print run. Let the tractor feed mechanism advance the paper normally. Any external tension on the paper may shift the slight clearance around feed pins and skew it out of alignment. Sudden misalignment causes horizontal or vertical streaking.

Displayed messages identify the color printed. When the last print run ends, you'll get a message to that effect.

Clean the print head before doing another printout that starts with a light-colored ribbon. Fold a piece of smooth firm paper towel into three layers and crease them into a U shape. With ribbon removed, slip the towel's U-creased area between the print head and its ribbon guide. Wait a few seconds and remove the towel. Repeat this action with an unused part of the towel until it comes out clean.

Flatten and smooth a color art printout with a wavy surface in two ways: Place it between two pieces of clean paper and press with a clothing iron set on low heat, or place it under a stack of magazines overnight.

Running the Program

To merge a color art program (Listings 2-4) with the main program (Listing 1), first save the color art program in ASCII format (SAVE "file/BAS",A). Run the program; when the message Coding in Progress appears on the screen, press and hold the space bar while the program steps through the printer codes. When the coding is complete, the program prompts you through the color art printing process.

Doing Your Own Art

Grafrax color art requires suitable sketching material, colored pencils or pens, and color ribbon cartridges. You'll need a sheet of graph paper to lay out your art sketch. Green- or black-lined paper with six or eight squares per 1/2 inch is ideal. Avoid blue-lined paper; it doesn't reproduce on most copiers. Get an 11- by 17-inch sheet for copying convenience.

Using a black ball-point or nylon tip pen, line the graph paper so that it's six squares wide by eight squares tall. See the layout sheet in Fig. 2 for examples.

Number the six-column blocks consecutively, starting with the topmost left-hand block. Number the lines in increments of 10. Allowing a 3/8-inch

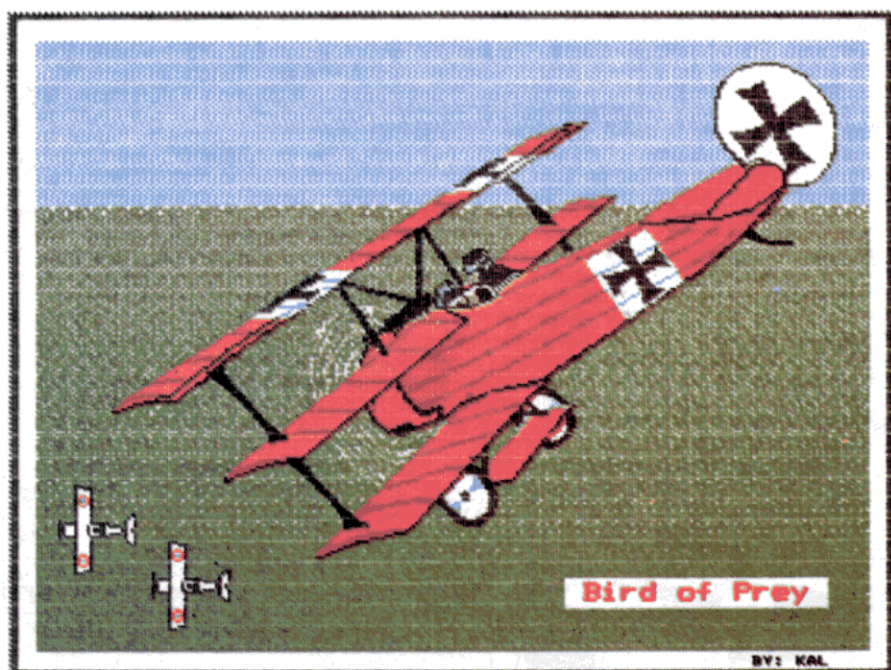


Figure 6. Bird of Prey five-color art.

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NAME

DESCRIPTION

1 RULE78	Interest Apportionment by Rule of the 78's
2 ANNU1	Annuity computation program
3 DATE	Time between dates
4 DAYYEAR	Day of year a particular date falls on
5 LEASEINT	Interest rate on lease
6 BREAKEVN	Breakeven analysis
7 DEPRSL	Straightline depreciation
8 DEPRSY	Sum of the digits depreciation
9 DEPRDB	Declining balance depreciation
10 DEPRDDB	Double declining balance depreciation
11 TAXDEP	Cash flow vs. depreciation tables
12 CHECK2	Prints NEBS checks along with daily register
13 CHECKBK1	Checkbook maintenance program
14 MORTGAGE/A	Mortgage amortization table
15 MULTMON	Computes time needed for money to double, triple, etc.
16 SALVAGE	Determines salvage value of an investment
17 RRVARIN	Rate of return on investment with variable inflows
18 RRCONST	Rate of return on investment with constant inflows
19 EFFECT	Effective interest rate of a loan
20 FVAL	Future value of an investment (compound interest)
21 PVAL	Present value of a future amount
22 LOANPAY	Amount of payment on a loan
23 REGWITH	Equal withdrawals from investment to leave 0 over
24 SIMPDISK	Simple discount analysis
25 DATEVAL	Equivalent & nonequivalent dated values for oblig.
26 ANNUDEF	Present value of deferred annuities
27 MARKUP	% Markup analysis for items
28 SINKFUND	Sinking fund amortization program
29 BONDVAL	Value of a bond
30 DEplete	Depletion analysis
31 BLACKSH	Black Scholes options analysis
32 STOCVAL1	Expected return on stock via discounts dividends
33 WARVAL	Value of a warrant
34 BONDVAL2	Value of a bond
35 EPSEST	Estimate of future earnings per share for company
36 BETAALPH	Computes alpha and beta variables for stock
37 SHARPE1	Portfolio selection model-i.e. what stocks to hold
38 OPTWRITE	Option writing computations
39 RTVAL	Value of a right
40 EXPVAL	Expected value analysis
41 BAYES	Bayesian decisions
42 VALPRINF	Value of perfect information
43 VALADINF	Value of additional information
44 UTILITY	Derives utility function
45 SIMPLEX	Linear programming solution by simplex method
46 TRANS	Transportation method for linear programming
47 EOQ	Economic order quantity inventory model
48 QUEUE1	Single server queueing (waiting line) model
49 CVP	Cost-volume-profit analysis
50 CONDPFOT	Conditional profit tables
51 OPTLOSS	Opportunity loss tables
52 FQOQOQ	Fixed quantity economic order quantity model
53 FQEOQSH	As above but with shortages permitted
54 FQEOQPB	As above but with quantity price breaks
55 QUEUECB	Cost-benefit waiting line analysis
56 NCFANAL	Net cash-flow analysis for simple investment
57 PROFIND	Profitability index of a project
58 CAP1	Cap. Asset Pr. Model analysis of project

59 WACC	Weighted average cost of capital
60 COMBAL	True rate on loan with compensating bal. required
61 DISCBAL	True rate on discounted loan
62 MERGANAL	Merger analysis computations
63 FINRAT	Financial ratios for a firm
64 NPV	Net present value of project
65 PRINDLAS	Laspeyres price index
66 PRINDPA	Paasche price index
67 SEASIND	Constructs seasonal quantity indices for company
68 TIMETR	Time series analysis linear trend
69 TIMEMOV	Time series analysis moving average trend
70 FUPRINF	Future price estimation with inflation
71 MAILPAC	Mailing list system
72 LETWRT	Letter writing system-links with MAILPAC
73 SORT3	Sorts list of names
74 LABEL1	Shipping label maker
75 LABEL2	Name label maker
76 BUSBJD	DOE business bookkeeping system
77 TIMECLK	Computes weeks total hours from timeclock info.
78 ACCTPAY	In memory accounts payable system-storage permitted
79 INVOICE	Generate invoice on screen and print on printer
80 INVENT2	In memory inventory control system
81 TELDIR	Computerized telephone directory
82 TIMUSAN	Time use analysis
83 ASSIGN	Use of assignment algorithm for optimal job assign.
84 ACCTREC	In memory accounts receivable system-storage ok
85 TERMSPAY	Compares 3 methods of repayment of loans
86 PAYNET	Computes gross pay required for given net
87 SELLPR	Computes selling price for given after tax amount
88 ARBCOMP	Arbitrage computations
89 DEPRSF	Sinking fund depreciation
90 UPSZONE	Finds UPS zones from zip code
91 ENVELOPE	Types envelope including return address
92 AUTOEXP	Automobile expense analysis
93 INSFILE	Insurance policy file
94 PAYROLL2	In memory payroll system
95 DILANAL	Dilution analysis
96 LOANAFED	Loan amount a borrower can afford
97 RENTPRCH	Purchase price for rental property
98 SALELEAS	Sale-leaseback analysis
99 RRCONVBD	Investor's rate of return on convertible bond
100 PORTVAL9	Stock market portfolio storage-valuation program

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blank margin, an 11- by 17-inch sheet with eight squares per 1/2 inch accommodates 20 lines of 42 blocks each. A sheet with six squares per 1/2 inch accommodates 15 lines of 32 blocks each.

Take your newly completed layout sheet to the nearest quick-print shop and make several copies. Save the original for more copies when needed. Work with the copies. You can tape two or more copies together for larger art sketches.

Using a pencil, lightly sketch your intended art's foreground, background, and art shapes. Since graph paper has a 1-1 ratio, vertically elongate all art shapes by about 20 percent. The extra height compensates for the print head's foreshortening effect, which prints at a 1-1.2 ratio of 60 dots per inch horizontally and 72 dots per inch vertically.

To print a nearly perfect circle, for example, you must sketch a 50-degree ellipse on a graph paper layout sheet. That's an oval six squares tall for every five squares in width. The layout sheet in Fig. 2 has dot circles spaced at a 1-1.2 ratio for true reproduction of the art sketch upon printout.

When your sketch looks good, put a color dot in the squares that make up the art shapes. There's no need to dot every square of a full-column pattern. A vertical line through the column will do. No need to fully color a solid or background area either. Outline solid areas with their respective colors. Mark blocks of shaded areas with pattern string designators (like P1, Fig. 1), then simulate the pattern with alternately spaced color dots adjacent to art shapes. See Program Listing 2 statement 3050 and Fig. 2 print line 50 for an example. The statement prints three blue P1 patterns, then 12 simulated column patterns to shade blocks 1-5 in line 50. The simulated pattern codes shade the sky portions in blocks 4 and 5.

The same technique applies to random column pattern backgrounds. Just fake some random patterns in partial background areas around an art shape. Your art sketch is ready for color-run programming when all its color areas are marked, outlined, or filled in.

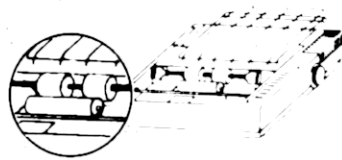
A numbered guide strip or scale with six-column spacing marks simplifies the programming task. Cut the bottom line of blocks off a layout sheet copy, then paste or tape it along the edge of a cardboard strip. Number the guide strip's blocks consecutively, starting with 1 at its left-hand end. Place the finished guide strip below the art sketch line to be coded. Use it to get quick counts of consecutive spaces, columns, and pattern strings.

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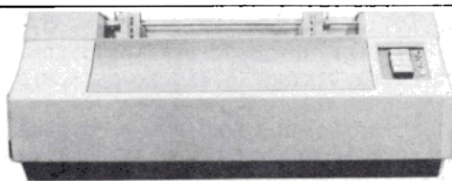
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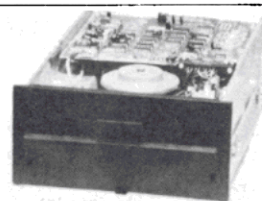
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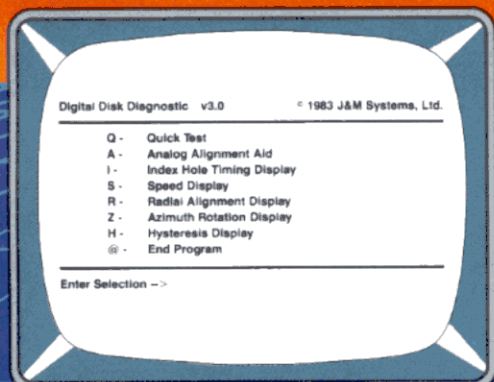
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B0;C0;B0;B0;B0;Q6;A1;A2;A1;A2;A2;A1;A1;A6;AR;BP;CJ;:T=142:GOSUB2
5
2270 T=12:LPRINTS2;BY;A9;A1;:GOSUB20:LPRINTQ6;:T=12:GOSUB20:LPRIN
TBE;:T=11:GOSUB20:LPRINTQ6;:T=42:GOSUB20:LPRINTB1;G1;E2;A1;A8;A
2;AQ;A4;AL;B3;CM;CD;:T=162:GOSUB25:P=EC+AK+FS+AK+H4+CK
2280 T=12:LPRINTS2;BY;A9;A1;:GOSUB20:LPRINTA7;A3;A6;AE;A3;AF;:T=
21:GOSUB20:LPRINTGA;H6;H2;Q6;H6;GA;H2;AM;BC;:T=6:GOSUB20:LPRINTH
G;HO;:T=107:GOSUB20:T=14:GOSUB15:T=12:GOSUB25
2290 T=39:LPRINTS2;BY;F8;Q1;:GOSUB20:LPRINTA9;AR;AE;Q6;AE;A9;AR;
A8;AV;BA;AN;BU;EL;C8;A7;A3;A1;E3;:T=106:GOSUB20:LPRINTSA;S4;BY;A
D;Q1;:T=12:GOSUB25:P=BN+AT+BD+BL+BB+AM
2300 T=42:LPRINTS2;BY;A9;A1;:GOSUB20:LPRINTQ6;:T=120:GOSUB20:T=1
4:GOSUB15:T=12:GOSUB25
2310 T=43:LPRINTS2;BY;A9;A1;:GOSUB20:LPRINTBP;CJ;:T=219:GOSUB25
2320 P=C0+G0+G0:T=88:LPRINTS2;BY;A9;A1;:GOSUB15:LPRINTG0
2990 GOSUB90
3000 CY="BLUE":GOSUB35:GOSUB5:P=P1
3030 T=44:LPRINTS2;BY;A9;A1;:GOSUB15:LPRINTCL
3040 T=36:LPRINTS2;BY;A9;A1;:GOSUB15:LPRINTCL;FA;CL;FA;CK;F8;CG;
F0;CG;F0;C0;E0;C0;E0;C0;E0;C0;E0;C0;E0;C0;E0;CG;F8;CG;F8;C
K;FA;P;P;CL
3050 T=36:LPRINTS2;BY;A9;A1;:GOSUB15:LPRINTCL;F8;QB;Q9;E0;C0;F0;
CG;FA;P;P;CL
3060 T=36:LPRINTS2;BY;GO;Q1;:GOSUB15:LPRINTS6;BY;AD;Q2;E0;CG;FA;
CL;FA;P;CL
3070 T=26:GOSUB300:LPRINTCM;FC;CK;FC;CO;F8;CO;FG;CG;F0;D0;F0;D1;
G2;F3;EA;EL;FA;P;P;P;P;P;A5;A2;Q4;S5;BY;AD;Q4;FA;CL;FA;P;CL
3080 T=24:GOSUB300:LPRINTCL;FA;CL;FA;CL;F4;CG;FG;FB;EG;EG;AG;
AI;AH;B2;C5;EA;A5;BA;CL;FA;CL;FA;P;P;P;P;P;P;P;CL;FA;CL;FA;A5;
AQ;S5;BY;AD;Q3;A5;FA;CL;FA;P;CL
3090 T=23:GOSUB300:LPRINTCK;F8;CG;F8;CG;F9;A2;A4;A4;A8;A2;A1;A2;
EA;AL;BA;CL;FA;:T=9:GOSUB15:LPRINTCL;FA;CM;FC;CK;F8;CG;FG;D0;G0;
C0;E0;S4;BY;AJ;Q1;A1;A2;A1;A2;A5;BA;P;P;CL
3100 T=21:LPRINTS2;BY;GI;Q1;:GOSUB15:LPRINTCL;FD;CR;FH;D1;F1;C1;
E1;A1;A2;A1;A2;A5;AQ;AL;BA;CL;FA;P;P;P;P;CL;FB;CN;FB;CM;FC;CK;FC
;CK;FC;CK;F8;CO;F8;CP;FB;CL;FA;P;P;CL;FB;CM;FA;CK;F8;CG;FG;D0;G0
;C0;E0;S4;BY;AV;Q1;A1;A2;A1;AQ;CL;FA;P;P;P;P;CL
3110 LPRINTTAB(20)BY;AI;Q6;A1;A2;A4;A8;AG;AG;AG;B0;C0;E0;E0;Q2;S
5;BY;BQ;Q4;A1;A2;A4;A8;A8;AG;B0;C0;G0;C0;C0;C0;C0;STRING$(9,128)
Q6;A1;A1;A2;A2;A4;A6;EA;AI;B2;C2;E2;E2;STRING$(5,4)STRING$(5,8)S
TRINGS(5,16)
3120 LPRINTTAB(19)BY;AI;Q1;A1;A1;A2;A4;A4;A8;AG;B0;B0;C0;C0;STRIN
GS(7,64)S5;BY;C8;Q1;A1;A1;A2;A4;A8;AG;B0;C0;G0;STRING$(13,64)E0
;A1;A1;A1;A2;A4;A4;A8;A9;AH;A1;B4;C4;C8;EG;AG;B0;B0;C0;E0;E0;
3121 LPRINTQ3;A1;A2;A2;A2;A4;A8;AO;AG;B0;B0;C0;E1;A1;A2;A4;A4;A8
;AG;B0;C0;E0;A1;A2;A4;A8;AG
3130 LPRINTTAB(17)BY;AO;Q3;A1;A1;A2;A4;A8;A0;AG;B0;D0;F0;STRING$(
9,32)Q3;S5;BY;C9;Q1;A1;A4;A8;AC;B0;C8;E8;STRING$(8,8)A9;A2;A2;A
2;A4;A4;A8;AG;AH;AH;B2;B2;C4;E3;E8;AG;AG;B0;C0;C0;E0;Q3;A1;A1;
3131 LPRINTA2;A4;E0;B0;A1;AG;B0;B0;C0;E0;E0;A2;A8;A4;A8;AO;AG;B0
;B0;C0;E0;E1;A1;A2;A4;A4;A8;AG;B0;B0;C0;E0
3140 LPRINTTAB(15)BY;AO;Q5;A1;A2;A4;A4;A8;AG;B0;B0;C0;E9;STRING$(
6,9)Q4;S4;BY;CG;Q4;A1;A3;STRING$(5,1)A2;G4;G8;E0;QA;Q2;A1;A1;A2
;A2;A4;E4;E8;A8;AG;AG;B0;B0;C0;E0;E0;Q2;A1;A1;A2;A4;A4;A8;A8;
AG;B0;C0;C0;E0;E1;QA;Q3;A2;A4;A4;A8;AG;AG;B0;C0;E0
3150 LPRINTTAB(14)BY;AI;Q1;A1;A2;A4;A8;AG;AI;B2;C2;E2;A3;A2;A6;A
6;A5;Q4;S6;BY;A6;Q1;A1;Z4;E0;S2;BY;BG;Q1;A8;AG;B0;B0;C0;C0;E0;E0
;Q4;A1;A1;A2;A4;A4;A8;AG;AG;B0;B0;C0;E0;E0;A1;A1;A2;A2;A4;A8;A8;
AG;B0;B0;C0;E0;E0;A1;A1;A2;A4;A4;A8;AG;B0;B0;C0
3160 LPRINTTAB(12)BY;AO;Q3;A1;A2;A4;A4;A8;AG;B0;C0;E0;A1;E0;E0;E
0;A8;A8;B0;C0;C0;E0;B0;B0;C0;S5;BY;C4;Q1;A2;A4;A8;AG;A1;A2;A4;A8
;AO;B8;C8;E8;STRING$(12,8)Q5;A1;A1;A2;A4;A4;A8;AG;AG;AG;B0;C0;C0
;E0;E0;A1;A1;A2;A4;A8;A3;AG;AG;B0;C0;C0;E0;
3161 LPRINTQ1;A1;A2;A4;A4;A8;AG;AG;B0;C0;C0;E0
3170 LPRINTSA;BY;AO;Q4;A1;A2;A2;A4;A8;A8;AG;B0;C0;STRING$(12,128)
)S6;BY;BU;Q1;A4;A2;A1;A3;A5;A9;AH;B1;C1;E1;STRING$(9,1)A2;A4;A1;
A1;A2;A2;A4;A8;A8;AG;AG;B0;B0;C0;E0;E0;A1;A1;A1;A2;A2;A4;A8;A8;A
G;B0;B0;C0;E0;E0;A1;A1;A1;A2;A4;A4;A8;AG;AG;B0;C0;C0;E0
3180 LPRINTS8;BY;AO;Q6;A1;A2;A4;A8;A8;AG;B0;CG;CG;EG;STRING$(9,3
2)S7;BY;BO;Q1;A2;A2;A4;A8;AG;B0;C0;E0;QA;Q5;C0;C0;E0;E0;A1;A1;A1
;A2;A2;A4;A4;A8;A8;AG;B0;B0;C0;E0;E0;E1;A1;A1;A1;A2;A4;A4;A8;AG;
AG;B0;C0;C0;E0
```

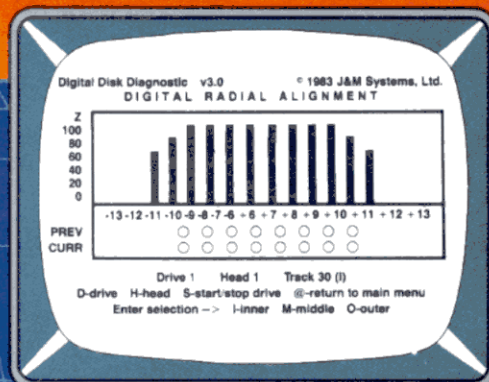
Next, key in all color print run fill-in statements for your Graflex art. When done, list and visually check all your keyed-in statements. Look for and delete ending semicolons in last statements for print lines. Look for accidentally inserted commas between alphanumeric codes. The comma after a spacing code adds 16 spaces, leaves a gap, and may

DISK DRIVE ANALYSIS PROGRAM

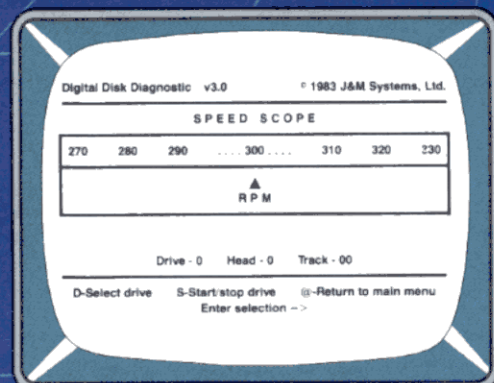
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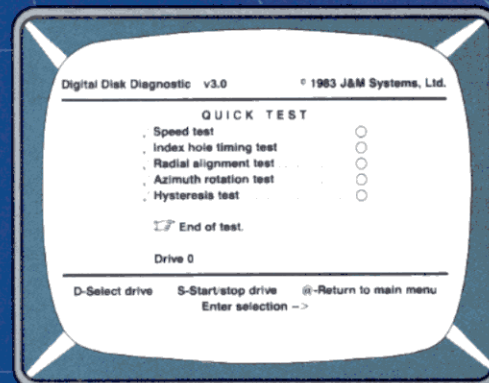
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TRS80 color

From the January 1981 issue of the CSRA Computer Club newsletter:

There was some amusement at the November meeting when the Radio Shack representatives stated that the software in the ROM cartridges could not be copied. This month's 68 Micro Journal reported they had disassembled the programs on ROM by covering some of the connector pins with tape. They promise details next month. Never tell a hobbyist something can't be done! This magazine seems to be the only source so far of technical information on the TRS-80 color computer. Devoted to SS-50 6800 and 6809 machines up to now, 68 Micro Journal plans to include the TRS-80 6809 unit in future issues.

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Listing 3 continued

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3190 LPRINTS7;BY;AI;Q1;A1;A1;A2;A4;A8;A8;AG;BG;CG;EG;EG;STRINGS(
7,32)S7;BY;BN;Q4;A1;A2;A4;A8;AG;BG;CG;EG;STRINGS(14,16)A4;A2;A1;
A2;A2;A4;A4;A8;AG;AG;B0;B0;C0;C0;E0;Q2;A1;A1;A2;A4;A4;A8;A8;AG;A
G;B0;C0;E0;E0
3200 LPRINTS6;BY;AI;Q1;A6;A9;AO;BG;D0;F0;G0;C0;C0;STRINGS(9,128)
S7;BY;AI;Q1;A1;A2;A6;EA;AI;B2;C2;E2;E2;STRINGS(9,2)S3;BY;BK;Q1;A
2;A4;A8;A8;AG;AG;B0;B0;C0;C0;E0;E0;A1;A1;A2;A3;A8;G0;G0;B0;B0;C0
;A1;A1;A1;A2;A2;A2;A4;A4;A4;
3210 LPRINTSTRINGS(7,8);Q3;A2;A2;A6;A0;BC;AK;BC;A4;A4;A4;A8;A8
3210 LPRINTTAB(15)BY;AI;Q1;A5;A9;AG;B1;C1;E2;STRINGS(12,2)S5;BY;
AV;Q1;A1;A6;A8;AG;BG;CG;EG;B0;B0;B0;C0;C0;E0;E0;STRINGS(5,
1)A2;A4;A8;AG;B0;A1;A6;A8;BG;C0
3220 LPRINTTAB(13)BY;AI;Q1;A1;A1;A2;A4;A8;AG;B0;C0;STRINGS(6,128)
Q4;S6;BY;B0;Q1;A3;A5;AP;AI;D2;E2;E4;A4;A4;A8;A8;AG;AG;AG;B0;B0;
B0;C0;C0;E0;E0;E0;A4;AG;B0;A2;A4;A8;AG;D0;E0
3230 LPRINTTAB(12)BY;AO;Q1;A1;A7;EA;AK;B4;C8;E8;AG;AG;B0;B0;B0;S
TRINGS(6,64)STRINGS(6,128)S5;BY;B0;Q1;A2;A4;AO;B0;C0;E0;Q2;A1;A1
;A2;A2;A2;A4;A4;A4;STRINGS(9,8)A1;A2;A8;A2;A4;B0;E0
3240 LPRINTTAB(19)BY;BE;Q5;A1;A2;A4;A8;AG;CG;EG;B0;B0;B0;C0;C0;C
0;E0;E0;E0;Q4;Q5;A4;AO;HO;HG;DG;AG;AG;B0;C0;C0;C0
3250 LPRINTS4;BY;A6;Q3;E0;E0;Q2;SA;S4;BY;B2;Q1;EC;AK;B8;G8;A8;AG
;AG;AG;B0;B0;B0;B0;STRINGS(5,64)STRINGS(11,128)AG;B0;BG;DO;DS;E0
3260 LPRINTTAB(17)BY;AS;Q4;A1;A2;A4;A8;D0;B0;A1;A1;A1;A2;A2;A2;S
TRINGS(7,4)STRINGS(6,8)
3270 LPRINTS4;BY;A6;Q3;A1;A1;Q2;S4;BY;A6;Q3;A4;A4;Q2;S6;BY;AF;Q6
;EC;AO;BG;CG;F0;B0;C0;C0;E0;E0
3300 GOSUB5:LPRINTS9;BY;A4;Q3;A8;A8
3990 GOSUB90
4000 CY="GREEN":GOSUB35:P=CL+FA+CL+EA+CL+BA:T=10:GOSUB10
4110 T=19:LPRINTS2;BY;G6;Q1;:GOSUB15:LPRINTC4;BA;CK;E8;CG;B0;C0;
Q4;A1;A2;A1;A5;AQ;AL;BA;P;P;P;P;BA;F0;C0;E0;Q8;A1;A2;A5;AQ;AL;
BA;P;C5;BA;CL;EA;CK;B8;C4;CG;E0;C0;Q2;S5;BY;B5;Q2;A1;A2;A5;AQ;CL
;P;P;P;P;P;FA
4120 P=P1:T=17:LPRINTS2;BY;FQ;Q1;:GOSUB15:LPRINTCL;FA;CK;F8;CK;F
0;CG;E0;C0;E0;Q3;A1;A2;A5;AQ;AL;AL;BA;CL;FA;CL;FA;P;P;P;P;CL;FA;
CK;F8;CG;F0;C0;E0;Q9;A2;A5;AE;AL;FA;CL;FA;CL;FA;CK;F8;CK;F8;CG;F
0;C0;G0;E0;E0;S6;BY;BB;Q1;A1;A2;A5;A2;BA;FA;P;P;P;P;P;P;HN
4130 P=CL+FE+CL+FA+CL+FA:T=15:LPRINTS2;BY;FE;Q1;:GOSUB15:LPRINTC
L;FE;CL;FA;CK;F8;CG;F0;CG;E0;C0;E0;Q3;A1;A2;A5;A2;A5;AQ;AL;BA;P;
P;P;P;F0;G0;D0;E0;E0;CG;G0;F8;CG;F0;G0;E0;Q8;A1;A2;A4;AS;AK;B
8;CK;HG;F0;CG;F0;G0;G0;E0;A8;E0;
4131 LPRINTS6;BY;BN;Q5;A1;A3;A5;AQ;BL;FA;CL;FA;P;P;P;P;P;P;HN
4140 P=CL+FE+CL+FA+DL+FA:T=14:LPRINTS2;BY;EA;Q1;:GOSUB15:LPRINTC
L;FE;DG;F0;D0;E0;E0;Q6;A7;A3;AL;BE;FA;P;P;P;P;CL;FE;CL;FA;DK;FA;
CK;F0;CL;F8;BO;B0;SA;S1;BY;BT;Q1;A1;A1;A3;A6;A3;AQ;BE;DA;CL;FA;D
L;FA;:T=8:GOSUB4000
4150 P=CL+HE+CL+FB+DL+FA:T=12:LPRINTS2;BY;E4;Q1;:GOSUB15:LPRINTC
K;HC;CG;F8;DG;F0;G0;E0;Q6;A1;A1;A2;A7;AD;AQ;AL;DB;DL;FA;CL;HE;CK
;FA;DL;FA;CL;HC;CL;HC;DK;FD;CK;HE;CK;FB;DL;FA;P;P;G0;Q5;SA;BY;C9
;Q4;A1;A1;A2;A7;AR;AL;DL;DL;FA;:T=10:GOSUB4000
4160 P=CT+HF+CL+FB+GL+FA:T=10:LPRINTS2;BY;DO;Q1;:GOSUB15:LPRINTC
T;HE;CL;FC;DK;F8;GG;F0;C0;E0;Q6;A1;A3;A1;A7;AE;AD;BL;CT;P;CS;HG;
CJ;G6;D0;ER;CL;HA;CT;GR;CP;F8;CT;HE;BV;D7;A3;D6;HI;ER;BP;CV;DF;F
L;CT;HE;CL;FC;C8;HG;SA;S1;BY;CF;Q1;A1;A3;A5;AE;AR;CL;
4161 T=12:GOSUB4000
4170 P=CT+HF+CL+FF+GL+FQ:LPRINTS2;BY;DC;Q1;P;P;P;P;P;P;P;CT;HE
;CL;FF;DK;FS;CC;FG;H0;D0;G0;E0;Q6;A1;A3;A2;A5;AE;AR;P;P;CT;HE;GL
;FF;C0;A7;AS;D1;E7;BK;H3;FE;AP;H3;EF;ET;CJ;BE;BD;CB;DU;FF;DL;FQ;
SA;S1;BY;CR;Q1;A1;A1;A1;A3;A5;AR;AN;AE;BF;DL;FQ;
4171 T=13:GOSUB4000
4180 P=CT+HD+GN+FF+GL+FQ:LPRINTS2;BY;DC;Q1;P;P;P;P;P;P;P;CS;HC;G
O;FO;D0;G0;E0;E0;Q8;A3;A7;AF;AN;CL;DF;DL;FQ;P;P;P;CT;HE;GL;E0;GV
;G3;BV;HS;EG;A7;EF;DG;DG;DN;HG;G2;AV;B0;D0;E0;Q4;S9;BY;D7;Q5;A1;
A1;A2;A5;AR;AE;AR;DQ;:T=15:GOSUB4000
4190 P=CT+HF+HL+FF+GL+FQ:LPRINTS2;BY;D6;Q1;P;P;P;P;P;CT;HE;HK;F8
;DO;FO;H0;C0;E0;Q9;A1;A1;A2;A5;AE;AR;BT;DF;HV;FF;DL;FQ;FF;P;P;P;
P;CT;HE;DV;AF;HG;AV;HS;BV;C0;G7;HS;A8;DG;C0;B0;E0;Q2;SA;BY;D7;Q1
;A4;BE;DV;FF;DL;FQ;:T=16:GOSUB4000
4200 LPRINTS2;BY;CQ;Q1;P;P;P;P;P;P;P;CS;H3;D1;E1;E1;A3;A2;A5;A7;A7;AD;
AF;AS;AE;AJ;A7;AF;AE;AR;AE;AF;AN;BV;FQ;P;P;P;P;P;CT;HC;HK;F8;B
0;E0;S2;BY;A6;Q1;A1;A2;A3;A1;A1;BQ;S9;BY;D7;Q1;STRINGS(5,128)G0;

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Listing 3 continued

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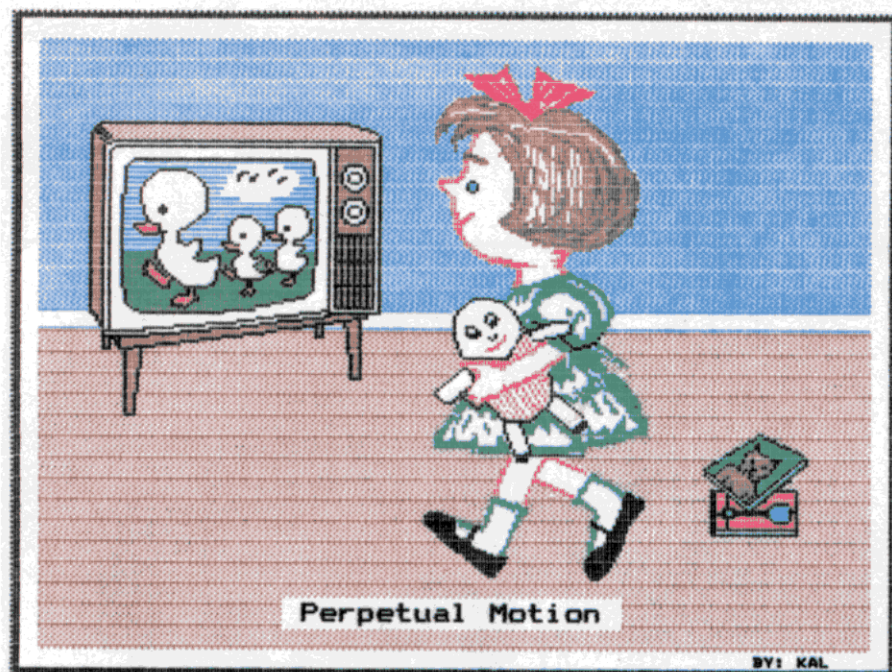


Figure 7. Perpetual Motion five-color art.

Continued from p. 160

stop the printer with a line overflow beep. A comma between column patterns codes prints a row of dots and shifts subsequent patterns to the right.

Save the combined program on tape, disk, or wafer. Then try running the program with the printer power off. Cycling through all the color print runs uncovers syntax errors that occur during program key-in. Do several dry runs to become familiar with displays that appear before, during, and after various color print runs. If your TRS-80 locks up, turn the printer power on and press the break key.

After the program checks out, try separate printouts of the color sequences. Use a black ribbon without backfeeding the paper between print runs. Compare these printouts with corresponding color areas of your art sketch. Fix wrong patterns or spacing intervals by changing codes in the bad print line's statement.

With syntax errors and pattern codes fixed, try a multicolor printout. Follow and comply with all displayed instructions.

Programming Differences

My programs don't use pattern codes AA, AB, or AC for CHR\$ 10, 11, or 12, so you can use the programs on a Model I or III. Model I users may incorporate codes AA, AB, and AC in strictly Model I Grafrax art programs. Conversely, Model III users must avoid the three codes.

In many cases, you can substitute other codes with similar patterns (but

with an extra dot). Pick a pattern where you can hide an extra dot in a darker color. For example, column 1 of block 7 on line 50 (Fig. 2) needed an AC code to print third and fourth dots red. I substituted an AE code which also printed the second dot. The later black print run hides the extra dot while printing black window frames.

If there's a 12-column dot graphics segment to code, you obviously cannot use code AC to specify an n1 value of 12. However, you can add six blank columns to either end of the segment for a total of 18 columns, then use code A1 for the n1 value.

Grafrax-80 and Grafrax-Plus have different character printing and spacing characteristics on mixed graphics print lines. Figure 5 shows the printing/spacing differences. The two examples shown are enlarged replicas of printouts using the same spacing test program.

With Grafrax-80, a dot-graphics segment ends anywhere within a six-column block. The print head then jumps to the next block's first column to print a character or do a space. With Grafrax-Plus, the print head moves to the very next column, no matter where a dot-graphics segment ends.

You may use skip- or all-column spacing to tailor programs for your version of Grafrax. But, using Q codes to account for all blank columns of an art sketch makes its program compatible with both Grafrax versions. A friend may have the other version. Or, someday you may want to upgrade or downgrade to the other version. Both have

certain advantages.

More Art Examples

Program Listing 3 prints a bird of prey (Fig. 6) in six-color print runs. With the main program, the Bird of Prey program requires about 30K bytes; 26,013 for program storage and the rest for strings and overhead. The combined program runs on a 32K tape or 48K disk system.

A red run has coding with only one loop for initial line feeds (line 1000). Tabs space to print points beyond 10 character blocks. Line 1290 prints the art title in emphasized upper- and lowercase characters. The statement's code EY turns the emphasized mode on for printing by the next 12 codes. These codes represent title character ASCII decimal values.

A brown run mainly covers the lower background with random column patterns for later overprint with green. Frequently redefined T values and loops through main program statements 20 and 25 print most of the column patterns. Simulated random patterns fill in the partial background areas around airplane outlines. Simulated P1 column patterns provide light shadow shading under horizontal tail surfaces (statements 2110 and 2120) and center wing (statements 2170-2200). Statements 2280, 2290, and 2300 leave a clear title window in the random patterned background.

A blue print run does the light blue sky, using 50 percent P1 patterns (see Fig. 1). Simulated P1 column patterns fill in partial sky areas around tail surfaces and right wingtips. This run also prints wing leading edge and rib lines, the windshield, and structural detail lines along the fuselage. Lines 3070, 3080, and 3090 define T values, then loop through routine 300, which sets the 480 mode for 222-dot columns to the rudder, then prints a T quantity of P1 patterns between the sky's left edge and the upper wing. The calling statement's codes complete the remaining sky segments to the right edge.

A green run overprints the random patterned brown background. Predefined patterns range from 50-percent green at the horizon (line 4110) to solid green in the last four print lines. Lines 4140-4270 access routine 400 to print green patterns behind the triplane on 14 lines above the title window. Defined printing patterns are altered within statements 4160-4230 to leave streaky propwash arcs around the triplane's nose.

A black run adds the pilot, guns, insignias, and all black detail lines. State-

```

GG;GG;HG;FF;DL;FQ;:T=15:GOSUB400
4210 P=CT+HT+HL+FF+GL+HQ:T=13:LPRINTS2;BY;CK;Q1;:GOSUB15:LPRINTG
O;HG;D0;G0;E0;E0;S2;BY;B4;Q1;A3;A4;A7;A9;BM;CP;DE;FJ;GT;DC;DN;AR
;AD;A6;A3;A1;A1;A2;STRING$(7,1)A3;A2;A5;A3;A9;AE;AO;AG;B0;C0;E0;
S2;BY;DP;Q5;A3;A5;AF;AV;AR;AO;QA;Q7;E3;DL;HQ;
4211 T=15:GOSUB400
4220 P=CT+HF+HT+FF+GL+Z1:T=11:LPRINTS2;BY;DU;Q1;:GOSUB15:LPRINTC
T;HE;HS;FC;GO;H0;G0;E0;H0;H0;G0;G0;G0;E0;Q7;A1;A3;A7;AD;AN;BV;BU
;GV;H7;DJ;GO;DE;FJ;CT;GM;DJ;BL;GQ;DD;BN;ER;HD;DM;DL;FJ;GT;GD;
4221 LPRINTET;DC;CS;CS;GO;FP;HO;DO;HG;F0;E0;E0;S3;BY;DP;Q1;AF;AT
;CU;HO;FG;H0;E0;Q3;A1;A7;A4;A2;A3;A3;A5;A6;AF;AN;BV;FF;DL;FF;Z1
;:T=15:GOSUB400:P=DT+HF+Z1+FV+FW+Z1
4230 T=10:LPRINTS2;BY;DO;Q1;:GOSUB15:LPRINTDT;HC;HG;D0;G0;E0;A1
A1;A2;A3;A7;A5;A7;AF;AE;AD;AV;AT;AV;AN;DV;DU;DV;BV;P;P;DT;HE;DV;
AV;GD;HN;CR;HL;GQ;DE;GN;DD;FL;CK;DU;FD;FL;FM;GS;EO;E0;E0;E0;E0;S
3;BY;DV;Q1;EO;DG;HO;HG;C0;A8;E0;Q9;A3;A7;AT;HE;Z1;FV;DN;Z1;
4231 T=17:GOSUB400
4240 LPRINTS2;BY;DI;Q1;P;P;H0;H0;F0;HG;FG;HG;P;P;P;P;P;P;P;P;DT;DE
;Z1;FV;DN;Z1;P;P;P;P;P;P;P;DT;HE;Z1;FV;DU;FS;ES;GG;C0;E0;Q2;S5;BY;
DP;Q1;A8;A1;AS;AV;BR;BV;BU;BV;Z1;FV;DN;Z1;:T=18:GOSUB400
4250 P=FV+HN+Z1+FV+DN+Z1:T=10:LPRINTS2;BY;A9;A1;P;P;Q6;P;DT;HF;Z
1;FV;DN;HU;DS;HC;Z1;FV;DN;Z1;:GOSUB15:LPRINTDT;HF;Z1;FV;DN;HO;HG
;D0;G0;QA;Q8;A1;A3;A7;AT;BV;AV;AE;A7;A1;QA;Q3;A1;AF;FV;DN;Z1;:T=
19:GOSUB400
4260 T=9:LPRINTS2;BY;A9;A1;P;DT;AG;G3;E1;E1;E1;Q6;STRING$(5,129)
G3;G2;C3;G3;H7;Q3;AO;Z1;FV;DN;Z1;:GOSUB15:LPRINTDT;HF;Z1;HU;HS;H
O;DG;G0;HG;HG;H0;H0;H0;D0;C0;Q6;A1;A1;A1;A3;A3;A3;A3;A7;AE;AV;BV
;DV;FV;DN;Z1;P;Z1;DU;BV;BR;AV;AV;AV;AN;AV;BU;DV;DF;
4261 T=20:GOSUB400
4270 P=Z2+HF+Z3:T=27:LPRINTS2;BY;A9;A1;P;P;Q6;P;Z5;DV;BU;BV;Z4;P
;Q3;E0;E0;E0;P;P;P;P;P;P;P;DV;Z4;HJ;H1;G1;E3;A3;A7;A7;AF;AF;AU;AV;
BV;BV;:GOSUB400
4280 LPRINTS2;BY;A9;A1;ZA;Z2;A7;A7;A7;AF;AF;AF;ZB;HU;HS;HS;HS;Q6
;STRING$(5,252)STRING$(5,254)HO;HG;H0;H0;ZE;Z6;ZE;STRING$(84,252
)ZA;Z2;HN
4290 LPRINTS2;BY;F8;Q1;ZC;Z3;AV;AF;AF;AF;Q6;STRING$(5,15)AV;AV;A
V;AV;BV;A7;A3;A1;G1;ZE;Z6;ZE;SA;S4;BY;AD;Q1;Z6;Z6;HN
4300 LPRINTS2;BY;A9;A1;ZD;Z2;Q6;ZF;ZF;STRING$(84,63)Z6;Z6;HN
4310 LPRINTS2;BY;A9;A1;ZD;Z2;BV;BV;BV;DV;DV;DV;ZF;HF;ZF;HF;ZF;HF
;ZC;Z3;HN
4320 LPRINTS2;BY;A9;A1;STRING$(99,192)STRING$(166,192)
4990 GOSUB90
5000 CY="BLACK":GOSUB35:T=3:GOSUB10
5040 LPRINTTAB(38)BY;AU;Q4;A1;A2;A4;A8;AG;AG;B0;B0;B0;STRING$(9,
64)B0;B0;AG;A8;A0;A4;A4;A3
5050 LPRINTTAB(38)BY;B4;Q1;A3;BU;H0;E0;Q3;A8;AS;AU;AU;AV;BV;DV;D
V;Z1;AV;A3;Q9;A1;A3;A1;E0;C0;B0;AO;A4;A3
5060 LPRINTTAB(38)BY;B7;Q1;Z1;QA;E0;G0;HG;HS;HU;Z2;DV;AF;A3;A7;A
F;AV;BV;DV;Z4;BV;AV;A7;A1;Q2;G0;DO;AF
5070 LPRINTTAB(29)BY;AI;Q1;A1;A1;A2;A4;A9;AI;CK;CK;C8;AG;B0;B0;E
0;E0;Q4;S6;BY;B7;Q1;HO;AE;A3;Q2;A8;AE;AF;AF;AV;AV;AV;BV;BV;DV
;HU;HS;HG;Z4;H7;H1;G0;G0;G0;STRING$(6,128)Q4;HF
5080 LPRINTTAB(26)BY;AO;Q1;A1;A1;A3;A3;A3;A2;Q2;A1;A1;A2;A4;A5;A
9;AI;B4;C8;EG;AG;B0;C0;E0;Q2;S8;BY;B7;Q3;E0;H0;BG;AO;AE;A3;E3;H1
;HS;HP;HH;G2;E2;A3;A1;A1;Q2;H0;HO;Z4;DV;AV;AF;A7;A3;A1;Q5;AF;HO
5090 LPRINTTAB(24)BY;AO;Q4;A1;A3;A7;AE;AS;AO;BO;DO;HO;GO;GT;ET;A
P;AI;B7;CF;EJ;AH;B0;C0;E0;SA;S1;BY;AV;Q2;A1;E2;G4;EO;B0;C0;STRIN
G$(7,128)C0;B0;AV;HO;HG;H0;G0;E0;E0;A1;A1;A1;A2;A4;AO;B0;G0
5100 LPRINTTAB(24)BY;AU;Q2;E0;E1;E2;E2;A4;A8;AG;AG;B0;C0;E0;E0;Q
5;E0;G0;H0;HO;DS;AU;AF;A7;A3;Q3;S3;BY;A6;Q2;A1;A2;A4;A8;Q1;S5;BY
;AU;Q1;A1;A2;A4;A8;AG;B0;G0;Q7;A1;A1;A2;A4;A9;AI;BC;CG;G0;STRING
$(7,128)
5110 LPRINTTAB(22)BY;AI;Q5;A1;A2;A4;A4;A8;AG;B0;C0;C0;E0;Q4;S3;B
Y;CE;Q1;E0;G0;HG;HS;DV;BV;AV;AF;A3;A1;Q7;A1;A2;A4;A8;AG;B0;C0;E0
;QA;Q1;STRING$(9,1)STRING$(8,2)A6;A4;A4;A4;A4;BK;C4;E4;A4;A4;A8;
A8;A8;AG;AG;AG;B0;B0;B0;C1;E2;A8;AO;B0;G0
5120 LPRINTTAB(21)BY;AI;Q1;A1;A2;A4;A8;A8;AG;B0;DV;DV;H0;DO;AU;A
7;A1;Q4;S5;BY;AU;Q4;A1;A3;A7;AF;AH;B0;C0;E0;QA;Q1;A1;A1;A3;A7;AF
;Q3;S4;BY;AP;Q6;A1;A2;A4;A8;AO;BO;HS;BS;AS;AE;A6;A6;STRING$(8,3)
5130 LPRINTTAB(19)BY;DN;Q3;A1;A2;A4;A8;A8;AG;B0;C0;E0;E0;Q7;Z2;

```

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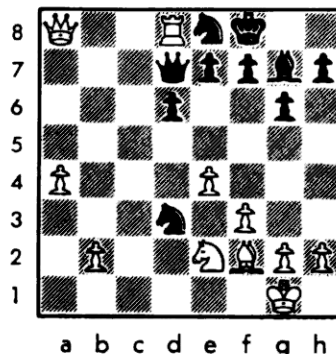
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2. g1-f3	d7-d6	18. d3-c2	e5-c4
3. d2-d4	c5-d4	19. e3-f2	b5-b4
4. f1-b5+	c8-d7	20. c2-b3	a6-a5
5. b5-d7+	d8-d7	21. d1-d4!	b7-b5
6. f3-d4	g8-f6	22. c3-b4	a5-b4
7. b1-c3	g7-g6	23. a1-c1!	c4-b6
8. e1-g1	f8-g7	24. c1-c8+	b6-c8
9. c1-e3	e8-g8	25. b3-c4	b5-d7
10. d1-d3	a7-a6	26. c4-b4	c8-a7
11. c3-d5	b7-b5?	27. b4-b8+	f6-e8
12. d5-b6	d7-b7	28. d4-c4	a7-c6
13. b6-a8	b7-a8	29. b8-a8	c6-e5
14. f2-f3	b8-d7	30. c4-c8	g8-f8
15. f1-d1	f8-c8	31. a2-a4	e5-d3
16. c2-c3	a8-b7	32. c8-d8!	resigns



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ment 5310 prints the lower small plane's left wingtip. It also checks whether Grafrax-Plus or Grafrax-80 is used, then sends control to either 5320 or 5321. Statement 5320's code NY turns on the compressed character mode, codes AR;CJ;A1 set the subscript mode, then the last seven codes print art credit BY: KAL within the border. Or, statement 5321's codes print the art credit in compressed characters below the border. Finally, a border run frames the art in any color you choose.

Bird of Prey makes a black/white/gray printout if you omit the green run. Just cycle through the green run with the printer power off.

Program Listing 4 prints Perpetual Motion (Fig. 7) in nine print runs. Although Fig. 7 has only the five readily available colors, you can use up to nine if you have the color ribbons. You can also use one ribbon to get a black/white/gray printout, but skip the hair and duck-parts print runs.

Combined with the main program, Perpetual Motion needs about 26K bytes for storage, strings, and overhead. The program runs on a 32K tape or 48K disk system.

A hair run prints the girl's hair a solid color with some highlights. Use a brown, yellow, or black ribbon cartridge for this run. A duck-parts run prints the ducks' feet and beaks. It also prints the cover background of the lower book on the floor. Use a red, brown, or orange ribbon.

A red run colors the hair bow and all facial, arm, and leg outlines. It also prints stripes on the rag doll's body. Use a red ribbon. Lines 2030, 2040, and 2050 print the hair bow in 960 dot-graphics mode to produce a deep red. Subsequent statements use the 480 mode for lighter red outlines.

A brown run outlines and shades the

girl's hair, colors the TV cabinet, does the floorboards, and prints the cat on the upper book's cover.

A blue run prints the background wall, using 50 percent pattern P1 (Fig. 1). This run also prints the TV screen's sky background and center part of the lower book's cover.

A green run prints the TV screen's lower background and the upper book's cover background.

A dress run colors the girl's dress and outlines her socks. Any color may be used for this print run. A border run frames the art in any color you want to use.

Finally, a black run does all black details, prints the art title, and adds the art credit. Title and art credit print as described in Bird of Prey.

The various print runs access GO-SUB routines 100-760 and the main program's routines as needed. The routines print identical dot-graphics segments or T-defined quantities of six-column patterns. For example, routines at lines 320 and 400 print a T number of patterns plus one column without an ending semicolon. The routines print the last segments of wall and floor pattern print lines.

The routine at line 700 produces identical segments of the TV's left side on three print lines. The routine at line 740 prints four identical print line segments from the TV's left edge to the screen's left edge.

Greeting Card Procedure

Bird of Prey and Perpetual Motion are Grafrax art programs that easily fit into 32K RAM. Their 3 1/2- by 4 3/4-inch dimensions are ideal for printing greeting cards with personalized messages.

Draw a sketch for color art to fit on one quarter of an 8 1/2- by 11-inch print

sheet. Invert the sketch, renumber its print lines, and code the upside down column patterns in the required number of color print runs. Use few or no line feeds and spacing codes to position the inverted art within the print sheet's upper-left quarter. In the last print run, use enough line feeds and tabs to print your personalized greeting, poem, or message within the paper's lower-right quarter. Print your art and personalized message on a single sheet. Fold the sheet twice into a 4 1/4- by 5 1/2-inch card. The printed art appears right side up on the card's front cover. Your message is inside.

Grafrax Art Limits

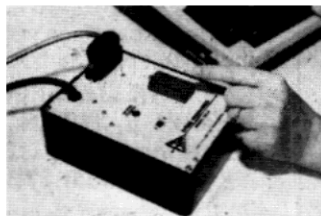
Art printouts are limited by printer width and paper size. Vertical and horizontal printouts up to 8 by 10 inches can be made on an MX-80 with normal fan-fold paper. An MX-100 extends the limits to 10 by 13 inches. The TRS-80's 48K capacity only limits the size of one fill-in program. You can solve the RAM limitation by using more than one fill-in program, each controlling one or more print runs.

For example, a 48K TRS-80 Model I disk system and an MX-80F/T printed the sailing ship (see the title-page illustration). The actual printout measures 7 5/8 by 9 1/8 inches. I used three separate fill-in programs, averaging about 25.5K with main program routines. I loaded and executed the programs in turn.

A two-run first program printed all black details, including the frame's edges, in one run. A second run textured the frame brown. Save spacing codes by using separate runs for black details and frame outline.

The second program's first run dot shaded the sails and colored the ship's structural parts and upper hull brown.

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The second run printed the hull's lower area and the masthead banner in 960 mode to produce a deep red.

The third program's first run did the sky in blue patterns progressively lighter from top to horizon. The first run also printed assorted wave patterns on the water's surface. A second run overprinted the blue wave-patterned water with assorted green patterns. I divided the water surface into four vertical areas to reduce coding requirements. The subdivisions allowed asymmetrical distribution of several predefined blue wave patterns over the water's entire surface. Subsequently printing predefined green patterns over the blue ones gave the water a random wave texture.

Graftrax color art programming is neither mysterious nor difficult. Start small, just to get the feel of it. Try single color art first, then do small color art for a little practice. You'll eventually become familiar with the codes and expand into larger color art programs. Seeing the end result of a program makes all the effort very worthwhile.

If you'd like reproducible 11- by 17-inch art layout sheets in three scales, an enlarged pattern code chart (like Fig. 1), and some programming/debugging aids, mail \$2 to me. ■

Write to Francis S. Kalinowski at 16 N. Alder Drive, Orlando, FL 32807

Listing 3 continued

```
3;E0;H0;DO;BS;AF;A3;Q4;AF;AV;BV;DU;DT;DR;CN;BE;AD;A3;A1;A1;A1;Q8
;A1;A2;A4;A6;AG;B0;C0;E0;Q2;E0;H0;G0;G0;QA;Q1;C0;G0;H0;HG;HO;HU;
Z1;DV;AF;A3;A1;A3;A7;AF;AV;Z1;
5131 LPRINTBV;AV;A3;A1;QA;Q1;A1;A2;A4;A8;AG;B0;C0;E0
5140 LPRINTTAB(15)BY;CE;Q5;A1;A1;A3;A7;AE;AE;AS;BO;AO;AG;Q3;A1;A
3;A7;AE;AJ;B3;C3;E1;E1;A1;Q3;S2;BY;BA;Q2;Z2;Q5;A1;A2;A4;G7;HI;DP
;AU;A7;G0;B0;B1;C2;G2;Z1;HU;DU;Z3;HU;HT;HQ;HK;D8;CG;CG;D0;C0;E0;
5141 LPRINTQ5;S3;BY;B1;Q1;AG;AO;AU;AV;BV;BV;BU;DS;DO;HG;HG;HU;Z2
;GF;E3;E1;Q7;A1;A2;A4;A8;AG;B0;C0;E0
5150 LPRINTTAB(14)BY;CE;Q1;A1;A1;A3;A7;AE;AE;AS;BO;DG;HG;HG;HG;D
G;DG;DQ;DI;D4;G8;AG;AG;B0;C0;E0;E0;E0;H0;DO;AU;A7;A3;E0;E0;E0;G0
;G0;G0;D0;D0;D0;D0;BG;BG;BG;AO;AO;AP;AF;AF;AF;Z2;AV;BV;BU;AS;Z1;
BH;AD;DV;DT;HP;HH;H7;H3;EJ;EF;A1;A2;H2;
5151 LPRINTHS;HS;HO;DO;EG;D0;E0;Q2;S5;BY;AO;Q4;E0;H0;G0;Q6;E0;HS
;HT;HQ;HI;H4;G8;EG;B0;C0;E0;E0
5160 LPRINTTAB(13)BY;CE;Q6;E1;E2;E4;E4;A9;AI;A4;A4;A8;AG;AG;B0;C
0;E0;QA;Q5;E0;G0;HG;DS;AV;A7;A1;Q3;A1;AF;AF;AV;BV;BU;Z1;HS;HO;HG
;HG;H0;H0;E0;G0;Q5;E0;C0;C0;B0;B1;A1;AS;A8;S7;BY;AE;Q6;A1;A2;A4;
A8;A8;AG;B0;C0;E0
5170 LPRINTTAB(12)BY;AI;Q1;A1;A1;A2;A4;A4;A9;AI;B4;C4;C8;EG;B0;C
0;E0;Q3;S4;BY;B4;Q3;AO;GR;HK;HS;DU;GF;E3;E0;E0;E0;D0;E0;QA;A1
;A2;A4;A8;AG;B0;C0;E0;Q4;S5;BY;AH;Q8;A1;A2;A2;A4;A8;AG;B0;B0;C0;
E0
5180 LPRINTSA;BY;AI;Q5;A1;A2;A2;A4;A9;AJ;B7;CB;EG;B0;C0;C0;E0;Q1
;S6;BY;AO;Q2;AS;H0;E0;Q3;E0;G0;G0;Q6;A1;A2;A4;A8;AG;B0;C0;E0;S6;
BY;AD;Q4;A1;A2;A4;A3;AG;BG;B0;C0;E0
5190 LPRINTS9;BY;AO;Q3;A1;A2;A4;A8;AH;B2;C4;E8;A8;AG;F0;G0;H0;HG
;HO;HS;DU;AV;A7;A3;A1;Q1;S6;BY;AI;Q9;A1;A2;A4;A8;AG;BE;C3;E0;Q2;
S4;BY;AL;Q2;A1;A1;A1;A1;A2;A2;A2;A4;A4;A4;A8;A8;A9;AJ;AN;B
R;CH;E1
5200 LPRINTS6;BY;BG;Q1;A1;A1;A1;A2;A2;A4;A4;A8;A8;A8;AG;AG;AG;AG
;BG;CG;CG;CG;CG;EG;AG;B0;C0;E0;QA;Q4;E0;G0;H0;HG;DS;AU;AF;A3;A1;
Q1;S5;BY;C6;Q1;A1;A2;A4;AE;AH;B0;C0;E0;Q7;H0;BG;AO;A6;A3;A1;A1;A
1;A1;A3;A2;A7;A2;Q2;A1;A2;A4;A8;A8;AG;AG;B0;B0;C0;C0;E0;Q9;A1;
5201 LPRINTA7;A9;BP;CD;E7;E3;E1;E1;E1;G0;G0;H0;DG;BO;AO;A9;A3;A4
5210 LPRINTTAB(13)BY;C2;Q4;G0;H0;HG;BS;AV;AF;A7;A3;A1;QA;Q6;A1;A
2;A4;A8;AG;B0;C0;E0;Q4;E0;D0;AG;A4;A2;A1;A2;A3;A7;AF;AF;AE
;A6;A4;E4;E8;E8;EG;AG;B0;H0;H0;C0;E0;S2;BY;AS;Q4;A3;A4;A8;AG;D0;
HG;HO;HG;STRING$(8,128)A1;A2;A4;AO;D0;E1;Z2;DS
5220 LPRINTTAB(14)BY;AO;Q3;H0;H0;G0;G0;G0;G0;Q6;A1;A2;A4;A8;AG;B
0;C0;E0;Q2;S3;BY;A6;Q2;E0;E0;E0;Q2;S3;BY;B1;Q4;A1;A7;AF;AG;D0;E0
;QA;Q1;A1;A6;A8;B0;CS;BS;AS;BO;BO;DG;H0;G0;E0
5230 LPRINTTAB(12)BY;AU;Q4;A1;A1;A1;A2;A2;A4;A4;A8;A8;A8;AG;AG;A
G;B0;B0;B0;B0;D0;DG;DO;DS;DU;EV;AF;A3;A1;Q1;S7;BY;AQ;Q4;A3;A4;AE
;AU;CE;EF;A7;Z2;Q9;A3;A4;AO;B0;G0
5240 LPRINTS4;BY;A6;Q1;AV;AG;AG;A8;A8;AF;S7;BY;B4;Q1;G0;C0;E0;QB
;Q3;E0;G0;H0;DO;BS;AU;A7;A3;A1;Q1;S5;BY;AR;Q3;A1;A3;A4;A8;BG;C0;
E0;A3;A7;A3;Q3;E0;H0;HO;DV;BV;B3;B0;C0;C0;C0;C0;E0
```

Listing 3 continued

COTTAGE SOFTWARE

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```

5250 LPRINT$4,BY,A0,Q1,Z1,Q4,Z1,Q4,Q1,A1,A2,A3,Q4,S9,BY,BP,Q4,E0;
; H0;HG;BS;AV;AF;A7;A3;A1;QB;A1;A2;A4;A0;B0;C0;H0;HG;DO;AU;AF;A7;
A3;A1;E1;E0;Q2;A1;A3;A7;Z1;HU;HG
5260 LPRINT$3,BY,AU,Q2,Z1;BS;C2;C2;C2;Z1;Q3;BS;G3;CQ;CQ;DU;DU;C2;
; B4;B4;B4;A4;A0;Z1;Q1;A4;H7;Q4;SA;BY;BG;Q3;HG;HG;H0;H0;D0;C0;
B0;STRINGS(5,1)A2;A2;A2;A4;A4;A4;A8;AG;B0;C0;E0;QA;E0;G0;S0;
TRINGS(6,224)G0;E0
5270 LPRINT$4,BY;B4;Q1;Z1;Q4;Z1;Q4;Q1;E0;C0;G0;QA;Z1;E0;E0;C0;C0;
; DV;S7;BY;AG;Q1;A2;A2;A4;A4;A8;A8;AG;B0;B0;C0;E0;E0;E0;E0;
5280 LPRINT$4,BY;A6;Q1;HO;A8;A8;AG;AG;HG;S3;BY;A0;Q2;AF;A1;A2;A2;
; A2;Z1;Q3;A1;HU;A2;A2;A3;A3;A2;A1;A1;A1;E1;A7;A8;AG;AV
5290 LPRINT$8;BY;AQ;Q2;HS;H0;AG;AG;Z1;Q3;H0;BV;GG;GG;HG;HG;AG;
; B0;B0;B0;G0;G0;HO;A4;G2;BU
5300 LPRINT$9;BY;A9;Q1;Z1;Q4;Z1;Q4;Z1;Q2;A8
5310 LPRINT$9;BY;A6;Q1;C0;C0;C0;E0;E0;E0;E0;E0;E0;E0;E0;E0;E0;E0;E0;E0;
5320 LPRINTTAB(40)NY;AR;CJ;A1;C2;CP;BQ;S1;CB;C1;CC;GOTO590
5321 GOSUB5:LPRINTTAB(40)NY;C2;DP;BQ;S1;CB;D1;DC
5990 GOSUB90
6000 CY="BORDER":GOSUB35:P=A3+A7+A3+A7+A3+A7:X=0
6005 LPRINT$;AU;A1;Q3;A5;A3;A7;T=46;GOSUB15:LPRINT$3;A7;A3;A5
6010 X=X+1:LPRINT$;A6;Q4;C1;Z2;SD;S6;BY;A4;Q2;Z2;CL:IFX<31;T=46;GOSUB1
010
6450 P=D0+DG+D0+DG+D0+DG:LPRINT$;AU;A1;Q3;CG;H0;HG;T=46;GOSUB1
5:LPRINT$0;HG;H0;CG
6990 GOSUB90
7000 CY="DONE":GOSUB35
7009 ; NOTE: ADD STATEMENTS 8990-9195 OF PROGRAM LISTING 1.

```

Program Listing 4. Perpetual Motion program.

```

94      PERPETUAL MOTION - GRAFTRAX COLOR ART
          FOR 48K LEVEL II TRS-80 MODEL I/III
          AND EPSON MX-80/L100 PRINTER WITH GRAFTRAX
          BY: FRANCIS S. KALINOWSKI
          16 N. ALDER DRIVE, ORLANDO, FL 32807
          NOTE: ADD STATEMENTS 1-90 OF PROGRAM LISTING 1.
100 LPRINTTAB(38)BY;AP;Q1;RETURN
1300 LPRINTS3;BY;AI;QA;Q1;Z5;Q3;SA;S1;BY;AI;Q6;:RETURN
1310 GOSUB300:LPRINTZ5;Z6;Q2;:RETURN
1320 GOSUB15:LPRINTGL:RETURN
1400 GOSUB15:LPRINTCL:RETURN
1700 LPRINTS3;BY;AI;QA;Q1;Z1;Q3;Z1;Q1;Z1;:RETURN
710 GOSUB720:LPRINTQ1;Z1;RETURN
720 LPRINTQ1;Z1;:RETURN
730 GOSUB720:LPRINTQ1;Z1;:RETURN

```

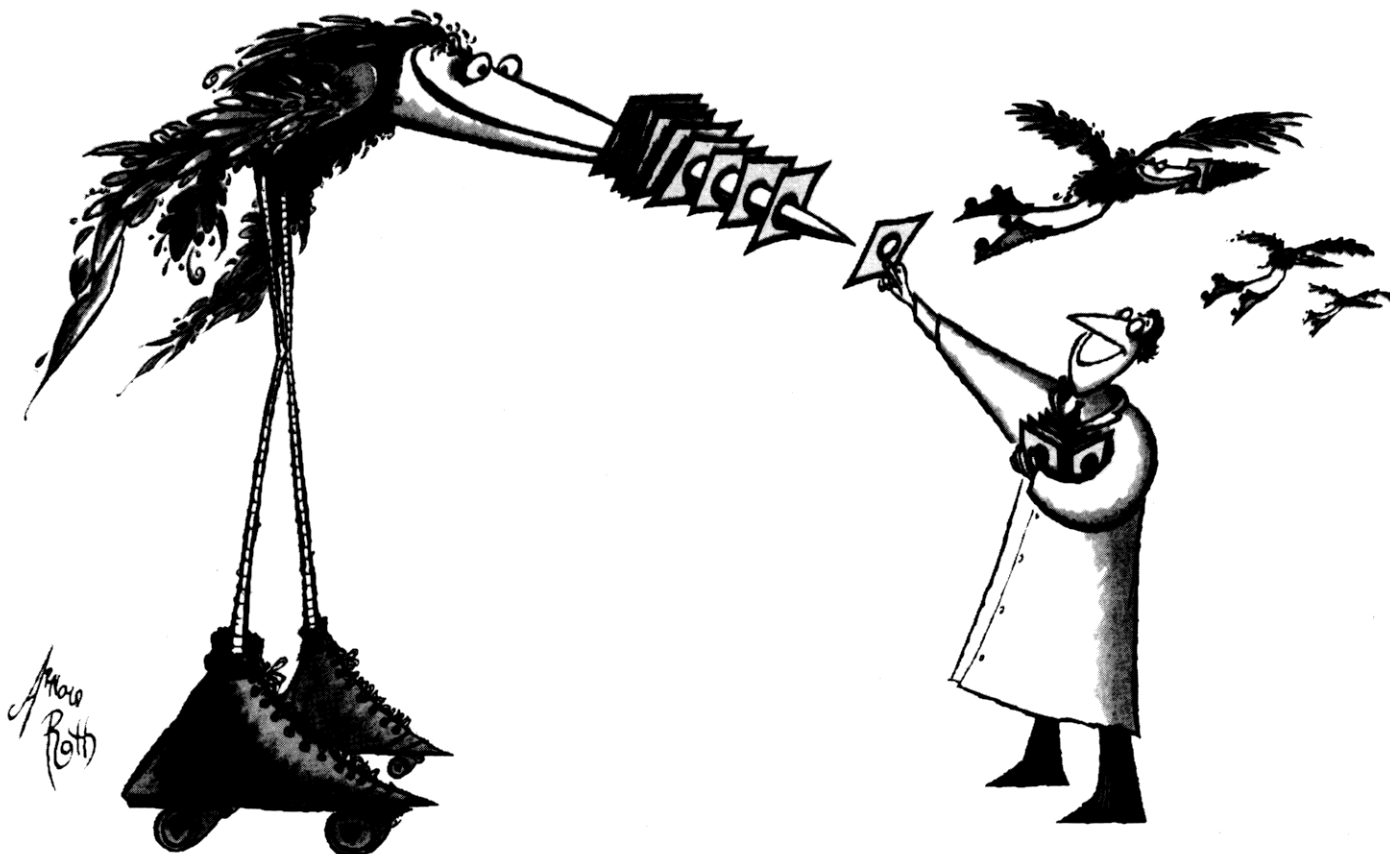
```

7400 GOSUB700:LPRINTBY;CL;Q3;Z1;:RETURN
7500 LPRINTS5;BY;A1;QA;Y1;Z1;Q2;:RETURN
7600 T=I3:LPRINTS21;BY;A9;A1;:GOSUB15:FORS=1TOI8:LPRINTP3;:NEXT:T=
I3;GOSUB320:RETURN
13:GOSUB CY="HAIR":GOSUB700:T=4;GOSUB100
1400 LPRINTTAB(24)BY;AF;Q1;A1;A3;A3;A3;STRINGS(6,7)A3;A3;A1;A3;
1
1450 LPRINTTAB(23)BY;BI;Q1;A1;A3;AF;BV;CV;HN;HF;HE;HF;HF;GV;GV;G;
GS(8,63)AV;AF;AF;A7;A3;A3;A1
1460 LPRINTTAB(23)BY;RQ;Q1;CV;HO;H0;HG;E0;A7;BV;HS;HS;HO;STRINGS
(5,240)H0;H0;HG;HC;Z3;HN;HJ;BP;DV;DV;FV;GV;STRINGS(6,191)STRI
NGS(6,223)STRINGS(7,239)HJ;HR;DT;BU;AV;AF;A7;A3;A1
1470 LPRINTTAB(24)BY;BN;Q1;H0;Q2;AS;AS;AE;AE;A7;A7;A3;Q3;E0;H
G;GS;HS;HU;Z4;DV;A7;Z1;H0;HS;Z2;A4;Z5;E0;Z1;H0;Z7;BV;EV;H7;HH
;HU;DV;AF;A3
1480 LPRINTTAB(27)BY;B9;Q1;G0;Z5;E1;Z2;DH;BS;E0;Z1;A1;Z1;G0;Z2;E
0;DV;E0;Z1;A1;ZA;Z4;DV;BV;BV;A7
1490 LPRINTTAB(27)BY;B9;Q1;A1;Z6;E0;H1;Z1;DS;DV;Z1;A2;Z1;AV;HF;Z
2;A1;Z2;E0;Z7;ZA;HO
1500 LPRINTTAB(26)BY;BF;Q3;A4;AF;AV;BV;DV;Z4;H7;A4;AF;Z1;AV;A3;H
U;Z1;AV;Z4;E3;ZB;HG;E0
1510 LPRINTTAB(27)BY;B4;Q1;G0;G0;H0;HG;HG;HO;HO;HS;HS;STRINGS
(8,254)ZA;Z1;HU;HS;HS;HO;HG;H0;G0
1490 GOSUB90
1500 CY="DUCK PARTS":GOSUB35:T=10;GOSUB100
1510 LPRINTS;BY;A9;Q1;STRINGS(9,1);'(LINE 10)
1520 LPRINTS7;BY;BG;Q1;E0;G0;H0;STRINGS(5,240)H0;B0;QA;Q8;A3;A3;
1530 A3;A1;AL;Q8;BG;BO;BS;BS;AS;AS;:(LINE 11)
1530 LPRINTS;BY;BE;Q4;A1;A7;A3;A1;QB;Q1;E1;G0;G0;G0;Q8;A7
;A7;A3;A1;:(LINE 12)
1540 LPRINTS;BY;BK;Q4;E0;H0;HG;HO;HS;DU;BV;AV;BV;AO;QA;Q5;C0;H0
;H0;HG;DO;BG;Q3;AF;Q5;G0;G0;E0;A4;AE;AE;DU;DS;:(LINE 13)
1550 LPRINTS;BY;AR;Q1;AE;AU;BU;BV;HU;HS;HO;AO;QA;Q3;C0;H0;G0;G0
;T=8;GOSUB10;:(LINE 14)
1560 GOSUB100:LPRINTAF;AF;A7;A3;A1;A1;A2;Q9;A1;A3;STRINGS(7,7):
;(LINE 130)
1570 GOSUB100:LPRINTZ2;H1;H1;H1;DJ;BJ;AJ;A3;A3;A3;AJ;BJ;DJ;HJ
;H1;G0;STRINGS(5,128)H1;Z1;:(LINE 140)
1590 GOSUB100:LPRINTSTRINGS(18,224)STRINGS(5,96)H0;H0;:(LINE 150)
1990 GOSUB90
2000 CY="RED":GOSUB35:T=3;GOSUB10
2030 LPRINTTAB(24)BW;C4;Q7;A4;A4;A6;A6;A7;A7;A3;A3;STRINGS(14,7)
AD;AD;AS;AS;DV;DV;A7;A7;A1;A1;QA;Q2;A1;A1;BV;BV;AF;AF;AE;AE;A7;A
7;A3;A3;STRINGS(6,1)
2040 LPRINTTAB(25)BW;CE;Q1;G0;G0;H0;H0;HG;HG;HO;HO;DS;DS;F
U;FU;GU;GU;HE;DE;DN;FR;FR;GV;HN;HN;DV;DV;AF;AF;A1;A1;Q4;Q4;A
3;A3;EU;EU;DR;DR;HN;HN;GF;GF;FU;FU;HU;HU;HT;HT;HR;HR;H7;H7;HF
;ZF;Z2;CU;CU;BU;BU;BS;BS;AS;AS;AO;AO;AG;AG

```

Listing 4 continued

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A1:HU:G2:Z1:HS

[illegible]

Listings 4 continued

A1;AU;A1;C0;E0;Q4;E0;Q9;AF;B0;B0;C0;A7;H0;H0;CV;E0;Z1;H0;Z2;A8;

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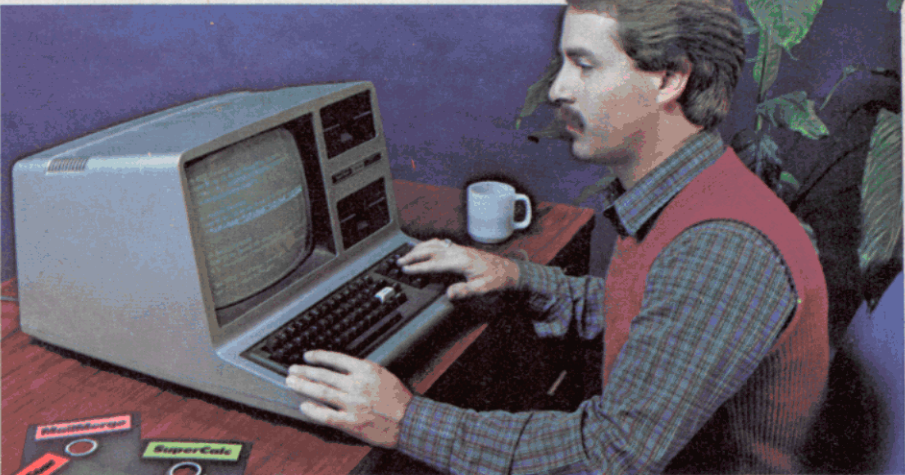
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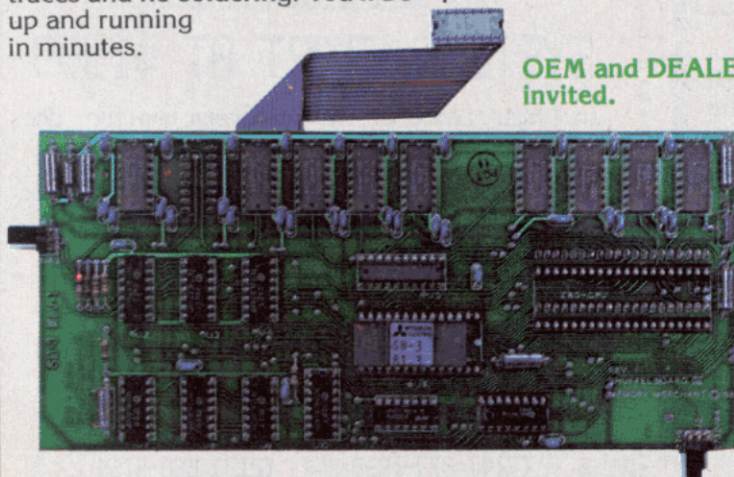
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8009 ' NOTE: ADD STATEMENTS 8990-9195 OF PROGRAM LISTING 1.



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This machine language program contains fast **animation, sound effects, tunes, and speech.** The speech has two options: it can be generated by computer or by a VS100 speech synthesizer (speech options described later). The program is easily controlled by a friendly menu-man who points to the options that may be chosen. The main menu contains four sections: • **Learn the Alphabet** • **Learn to Count** • **Learn Shapes** • **Learn Words**. Each section contains three subsections which can easily be manipulated, giving twelve games in all. The menu selection is accompanied by a different nursery rhyme tune for each menu.

LETTERS

This option allows the child to select letters at random, match the current letter displayed, or type in the next letter. When a correct response is given, an animation associated with the letter moves across the screen, e.g., Z for Zebra. The computer says the letters also.

NUMBERS

This option allows the child to select the numbers zero to nine at random, match the current number displayed, or type in the next number. Men walk out on the screen equal to the number chosen. This section also contains speech.

SHAPES

This section allows the child to control the menu-man, moving shapes from the left hand of the screen to the right hand of the screen. The first level allows the child to pick up shapes using the spacebar. The second level, in addition, allows the child to control the menu-man with the arrow keys. The third level puts a small 'Bee' on the screen which the child must avoid while manipulating the menu-man and shapes.

WORDS

This final section allows the child to type in letters to form words. The first level asks for a word to be typed in, then to be repeated before another word can be tried. The second level

prompts the child with a word which must be matched before an animation will appear on the screen. The last level shows the animation on the screen. Then the child must type in the correct word before the next animation is shown. This section contains speech also.

SPEECH

The program can be bought as a stand-alone program with computer-generated speech, which uses 'your' speaker amplifier. However, we have also made the program compatible with an 'Alpha Products VS100' speech synthesizer for improved speech quality. (This can be purchased from 'Alpha Products' subject to availability). The speech is not available for a 16K machine.

Software available for the **TRS80* Models 1, III, and IV.** Also soon available for the **Timex.** 16K tape (no speech). 32K tape. 32K disk. 48K disk. All programs for:

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Data-base Duo

by Wynne Keller

If you need the speed of an in-memory data base, read this comparison between Reader's Digest's ListMaker and SofTrends' Promise!

★ ★

ListMaker
Reader's Digest
Microcomputer Software Division
Pleasantville, NY 10570
Models I and III
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★ ★ ★ ★ ½

Promise! (formerly Aidsplus)
SofTrends Inc.
26111 Brush Ave.
Euclid, OH 44132
Models I and III
\$129

ListMaker and Promise! are two new in-memory data bases for the Models I and III. The programs are very similar in basic intent, but completely different in the way they accomplish in-memory data management.

ListMaker isn't a bad program. It has some nice features, including the ability to split and merge files, change field locations, and produce printouts that support both text and data base records without a word processor.

However, ListMaker can't compete with Promise!. Promise! loads more rapidly, has far better searches and data displays, is easier to add to and edit, prints files that don't fit in memory, and manipulates files and fields with great sophistication.

In-Memory Data Bases

In-memory data bases like ListMaker and Promise! have a smaller data-handling capacity than their big brothers, random-access data bases. That's because any in-memory data base maintains all its data in the computer's random-access memory (RAM) as you work with it. When you finish working with the program, it saves the data on disk as a sequential file.

In a typical application (140 characters per record), about 200 items fit in memory. If you don't have enough room for an entire file, you divide your file in portions and work with one portion at a time.

Obviously, these programs become awkward to use if you have to split your file into too many sections. In-memory data bases have this limitation built in. (Random-access programs hold as many items as the disk allows and can access each item one at a time directly from the disk.)

But in-memory data bases have a clear advantage over random-access data bases in speed. They perform searches and sorts nearly instantaneously. And when you add records, you move from one record to the next without the brief but annoying disk access a random-access data base requires.

ListMaker

Reader's Digest, manufacturers of ListMaker, target the package for the

educational market, emphasizing school applications. But like all data bases, you can use ListMaker for any data-base application—business, school, or home.

ListMaker comes on a TRSDOS-formatted disk. You have to specify whether you want a Model I or Model III disk when you place your order. The manual states that you can back up the disk only once; however, I wasn't able to back it up at all because the manual doesn't supply the disk's password. The usual TRSDOS password, PASSWORD, didn't work.

The program requires a separate data disk. You can run it on a single-drive machine, but this involves a lot of inconvenient disk swaps.

ListMaker's 80-page manual is attractively printed on heavy paper in a three-ring binder. After several introductory chapters, the manual delves into chapters on business and educational applications. Depending on your intended use, skip to the appropriate section.

Each section presents essentially simi-



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lar material with either business or school examples. The final chapters provide more detailed information and include a flowchart of program operations and explanations of all menu commands.

Many sections of the manual are on the disk as a separate help option. Help isn't available from within the program; you have to save your data and return to the main menu to use this option. A Help menu lets you identify the problem and send the information provided to the printer.

Promise!

SofTrends supplies Promise! on a special disk that boots in a Model I or III, but doesn't include a complete operating system. You supply a disk with an operating system on it and follow simple instructions to transfer the programs onto your disk. I used DOS-PLUS, but the program is compatible with all major operating systems.

You still have room on a double-density disk for some files after you transfer Promise!. Promise! is easier to use than ListMaker if you have only one drive. Two-drive owners will probably want to put all the Promise! companion programs, such as CALCS and FORMAX, on the disk with Promise! and maintain a separate data disk.

Promise! isn't protected. You can move the programs that make up the Promise! system about at will to make room for files.

The Promise! manual I used was a preliminary version. The final version will be printed in a spiral-bound 5½- by 8½-inch booklet.

The program screens display references to pages in the manual. If you have trouble with any screen, you know where to go for help. Unlike ListMaker, the Promise! Help function is available from the main menu and you don't need to save the file in memory before using it.

Another Help feature I like is the flash on the screen whenever you make a mistake. You can see the flash even if you're not looking directly at the screen. It's a warning that you're doing something wrong.

Initialization

As its name implies, ListMaker isn't a full data-base management program. This is evident in its maximum field length (30 characters) and the lack of its calculation ability. The program is designed for mailing lists and similar groups of short data.

ListMaker allows no more than 12

fields and you must state at the outset how many you intend to use. Then you enter the field name and length; you have an opportunity to make corrections at the end of the initialization process.

ListMaker permits only one field type: alphanumeric. Since the program doesn't perform calculations, you have no need for numeric fields.

When you finish initializing, name the file and write it to disk. This is called the List Format File and you must load it at the beginning of every session. You can establish as many list formats as you want.

Promise! allows eight more fields

*"Promise! allows
eight more fields
than ListMaker
and...you can use
subfields by combining
several short fields
into a single one."*

than ListMaker and, if you need more than 20 fields, you can use subfields by combining several short fields into a single one. You can still access such data separately via the subfielding search techniques. The total length for all fields can't exceed 255 characters per record.

As you initialize fields, the screen shows how many bytes you've used and how many records would fit in memory if you stopped initialization at that point. This information is highly useful. You want as many records as possible to fit in memory, and with this feature it's easy to fine tune the data base to its most efficient size.

You can edit, delete, or insert fields at any point in the initialization process. The Promise! editor is more sophisticated than ListMaker's.

Promise! supports numeric fields because even the core program provides totals and subtotals, and because the CALCS program offers more sophisticated math. During initialization, specify whether you want a decimal point and decimal-place accuracy.

As in ListMaker, you must save the field information for Promise! in a descriptor file. When you name the file, Promise! encourages you to add the suffix /DSC, so it is easy for you to distinguish descriptor files from data files.

These files are important; they are the map by which both programs read your

data. The Promise! descriptor files also contain search specifications and report formats; therefore, it's useful to keep the descriptor file up to date.

You can use both programs for many different projects, so devise a file-naming scheme that clearly connects the descriptor file with its own data. A Model III disk holds a lot of data, and it's easy to forget which descriptor goes with which data file.

Add, Search, Edit

To add data to ListMaker, load the appropriate list format file, then select the Add option from the main menu. The field names appear on the left side of the screen, and an adjacent line indicates the field length.

ListMaker permits very little editing. If a typing error occurs, press the left-arrow key to go back and change the error. Unfortunately, the Model III's auto repeat is disabled so you must press the key once per character. A shift/left-arrow key sequence erases the whole line.

At the end of each field, press the enter key to go to the next line. It isn't possible to return to a field once you press the enter key and you can't make corrections at the end of each record. This can be annoying, since you might not notice mistakes until the cursor is past the field in which errors occur.

Because in-memory data bases locate records very quickly, they normally don't use record numbers. To find any item in the file, the program makes a search. The search requires that upper- and lowercase letters match.

ListMaker offers three types of searches: in-string, exact match, or single-character. The in-string search starts at the left and finds all records matching the search characters. For example, Smi would find Smith, Smithfield, Smithye.

The exact match search, using the same letters, wouldn't find any name but Smi; longer names wouldn't qualify.

The single-character search looks for a character in a certain position, such as i as the third character. I tried the single-character search several times and it always locked up the computer. The other searches worked fine, and found a record at the end of the file in about 10 seconds.

All ListMaker searches must be for an "equals" condition. Greater than or less than searches aren't supported. You can make searches on only one field at a time. This might be insufficient for some purposes. If you want to

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sort by zip code, then by last name, this isn't possible.

When ListMaker finds the record, it appears in its entirety with additional choices at the top of the screen. These include options to continue the search, move forward or back one record, edit, delete, or exit to the main menu.

It's possible to have more than one record on screen at a time, but the program displays only one field of each record. You can specify which field you want to see. For most purposes, viewing only one field is virtually useless. At the very least, you need two fields and even better would be as many fields as fit on screen.

You can customize how Promise! adds records to an amazing degree. You can decide to add only some fields of each record, and you can choose which ones you want and the order in which they appear. By customizing, you won't need to press the enter key to go past fields for which you don't have data.

Another nice feature is the automatic repeat of data in any fields you specify. If you're typing a lot of addresses in one state, you can preset the state field. If you do so for ME, for example, the program thereafter automatically prints

ME in that field until you change it. Make the change to another state by positioning the cursor over ME and typing in a new state abbreviation.

You can automatically increment number fields by one, which is very useful in entering checks, invoices, and other sequential data. It's also possible to set the program to automatically in-

"Very sophisticated searches are available with Promise!. No matter how complicated the search, the records appear in seconds."

voke the enter key at the end of these repeat fields.

You can make corrections at any time during the Add process, and the arrow keys move the cursor to any field on the screen. One of the big drawbacks to the original Basic version of Aids was the slow speed of cursor movement. The new Promise!, written in machine-lan-

guage code, is greatly improved in typing and cursor movement speed.

When editing records, you can specify which fields to edit. The chosen fields are the only ones that appear on screen, and the cursor is at the end of the field, ready for additional information or a shift/left-arrow key sequence to erase the field.

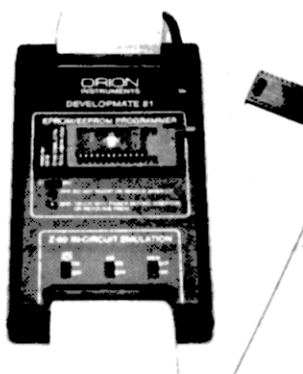
By pressing the clear/left-arrow keys, you can have full featured editing within the line. This new edit function permits insertion and deletion of characters.

Very sophisticated searches are available with Promise!. No matter how complicated the search, the records appear in seconds.

Promise! displays searched records with a single line for each, so it's easy to make comparisons with adjacent records. However, in most cases the entire record isn't displayed. You can choose which fields to display, or you can see fields that don't fit on screen by pressing the shift/right-arrow keys to move the fields horizontally.

You can also scan records vertically as though the screen were a cylinder. The end of the file is marked with a dashed line and the beginning reappears just below it.

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When the In-Circuit-Emulation cable is plugged into the Z-80 socket of your stand-alone system, the system becomes a part of your TRS-80. You can use the full power of your editor/ assembler's debug and trace program to check out both the hardware and the software. Simple test loops can be used to check out the hardware, then the system program can be run to debug the logic of your stand-alone device.

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Unlike ListMaker, Promise! supports all Boolean logic (greater than, less than, equal to, not equal to) and searches multiple fields with And or Or connections between fields. It's possible to compare fields within the same record and to specify certain character positions as irrelevant to the search.

I particularly like the fact that Promise! retains search criteria for reuse. You can set up four search formulas, then start displaying records according to each formula in turn. Switching from one search to another involves pressing one key, and the results appear before you can blink.

You can easily mark or unmark records. Use this sophisticated feature on one record at a time, or on all records that satisfy the search criteria.

Once you mark records, they become a separate entity within the file and you can manipulate them as a group. Promise! also handles new (recently added) and old (previously added) records as separate groups. There is no limit to the manipulation possible with the search function.

The program retains the formula most recently specified for a search for subsequent operations, such as editing,

printing, or disk saves. Be careful here. This is powerful and useful, but it's important to pay attention to what you're doing or you might save only the records that meet some search criteria when you intend to save the whole file.

The program provides warnings to help prevent mistakes, and after some functions such as delete, the current selection changes back automatically to all records.

Printouts

ListMaker combines limited word processing capabilities with its report function. It's possible to print explanations with each field, or even do simple form letters.

The report section is a separate program that you load from the main menu. When you're moving between different parts of ListMaker, the Reader's Digest logo appears on screen and stays long enough to be irritating. Although the manual doesn't mention it, pressing the enter key removes the logo and moves to the next section.

After the report program loads, a rather complicated menu appears. The first step is to create a print file, the list of words and field numbers you want

printed. Print files are either current or standard. The current one is in memory. The standard one is created when you originally establish the file.

Unfortunately, I couldn't find a way to make any particular file become the standard if I bypassed that option at initialization. If you want a standard print file, be sure to design it when you create the format file.

You'll need a certain amount of trial and error to create a good print file, especially if you use the word processor capability. Type any words, inserting field numbers between the < > signs where you want the field contents printed.

In very simple reports, you might have no words, just field numbers. Fancier reports can include descriptive phrases for the fields.

A letter is the most difficult, because you must terminate each line with the enter key. A printout has 80-character lines, but the screen displays only 64. You must guess or count to ensure that you press the enter key at least every 80 characters.

ListMaker tabs over any number of spaces, and even fills the blanks created with a character of your choice, such as

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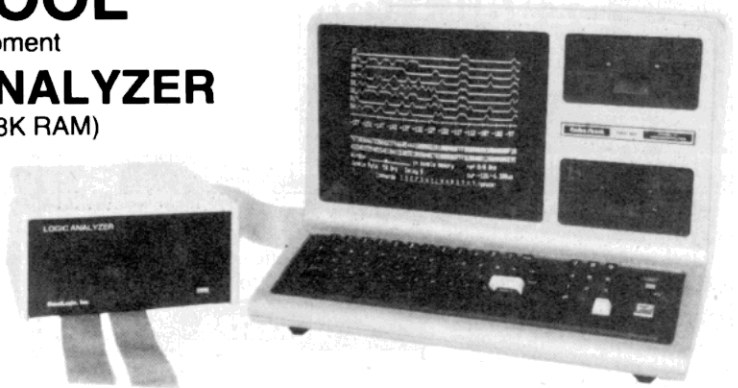
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a dash or dot. Sophisticated formats let you separate a field broken by a comma into its two components.

You can break up a field in the last name, first name format for the report. Place the first name in front of the last name, or print the last name or first name alone.

The report function also supports limited logic. You can print the contents of a field if there is anything in it, and a different field if the first field is empty.

When the print file is complete, you can edit for corrections. The editor is difficult to use, and I easily made a mess of my print file as I tried to edit it.

The editor is better than none at all, but considering the sophistication of most program editors these days, it's hard to see why ListMaker couldn't have a nondestructive cursor. It should be possible to make corrections within the line as you work on it, instead of typing below the line and pressing the enter key to see the effect of changes.

For the printout, you can select page size, left margin, and paper type. You have an opportunity to type a heading. I typed one in and as soon as I pressed the enter key it went directly to the paper with no warning for adjusting the paper

position.

The program is supposed to support wide type and centering for the heading. It didn't work with my printer, and I can't find any list in the manual of supported printers. The manual implies that these features work on any printer

*"If you don't own
a word processor,
you might find
ListMaker's print
function useful indeed."*

that provides these features, but this is untrue.

The sophistication of the print package in this program is unusual for a data base. Most data bases don't allow mixing text and fields except through a separate word processor. However, the print file is difficult to set up and even more difficult to edit.

Most people who already own a word processor would find it much easier to prepare text that way. However, ListMaker has no provision for using a

word processor-created file. If you don't own a word processor, you might find ListMaker's print function useful indeed.

Promise! supports two printer routines. One is simple to use but unsophisticated; the other is sophisticated but complicated. Both routines send reports to screen, disk, or printer. The disk option prepares a report to be printed later.

The simple report is a single-line printout that supports page title, page length, left margin, and field selection. If you select more fields than fit on the page width, the programs wraparound the excess.

It isn't possible to send printer codes. This type of printout is convenient for casual use, but because of the one-line limitation, for most purposes you'll want the more sophisticated reports.

FORMAX, an integral part of the data base, creates reports in conjunction with a word processor. You design and type the form layout with any word processor, then FORMAX prints the records from within Promise! placing fields where indicated. FORMAX also prints files too large to fit in Promise! (those created by merging two or more

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LD (HL).E
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Promise! files together).

FORMAX reads printer codes. You can move from one print size to another, underline, enhance, or do anything else your printer supports.

You can specify tabs within a line, skip any number of lines, strip trailing blanks from character fields and leading blanks from numeric fields, print part of a field, and reverse year, month, day fields to print as day, month, year.

Promise! supports logic, and you can print labels on any text on a conditional basis. For example, on an invoice form, logic can print "overdue" on any statement that shows the number of days since payment to be greater than 30. Conditional text can be any length.

It's also possible to prompt for operator entries. In this way, you can design a form that includes, for example, the current date, typed from the keyboard when you print the form.

Another unusual feature is the ability to convert numeric fields to their English equivalents. This is useful when you write checks, and Promise! does a creditable job of printing your checks on any check form you care to use.

FORMAX was designed for forms,

but you can also use it for routine reports. To format a two-line report, create only two lines in the print file, consisting of fields, tabs, and printer settings. When you want to print the report, specify the page length as two lines.

FORMAX goes through the file, considering each record as a page even though it's not printing on true separate pages. This works well with two limitations: You can't have a title or top and bottom margins. This is the only major drawback I could find in this print program.

As with ListMaker, you design a printout file through trial and error. With Promise!, this process is complicated by the use of a separate word processor.

If you have any problems with the file, you must exit from Promise!, load the word processor, edit the file, reload Promise!, reload the records, and try out the report. On the plus side, however, the word processor simplifies the creation of complex reports such as form letters.

File Functions

When you use a random-access data

base, your data is always safe because it's on the disk, not in computer memory. A power failure wouldn't cause the loss of much, if any, data.

With an in-memory data base, it's necessary to pay more attention to the file's condition. Data isn't recorded automatically; you must remember to save it at the end of each session or more frequently to prevent accidental data loss.

Promise! does have a fine utility program for data safety. After an accidental reboot or careless exit from the program, typing RECOVER/AID in DOS brings you back to Promise!, usually with the data safely in memory.

ListMaker tries to assist the operator with reminders. If you try to do anything that might destroy the items in memory, it warns you to save the records to disk. If you forget to bring an old file into memory before adding new records, you can still merge the old file with the new items.

This selection is confusing, though, because the warnings on screen imply that you'll destroy your file. If you proceed despite the warning, the program eventually asks if you want to erase the data in memory or merge the data with the file being read.

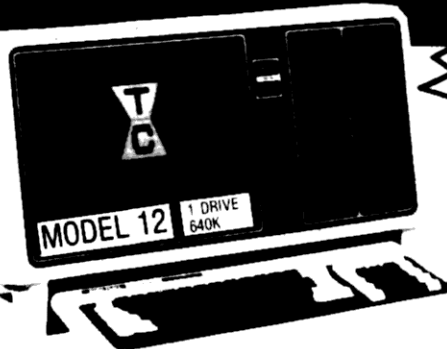
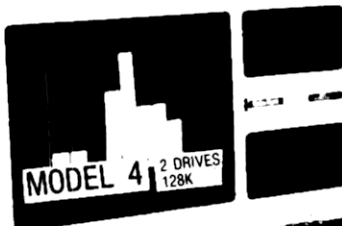
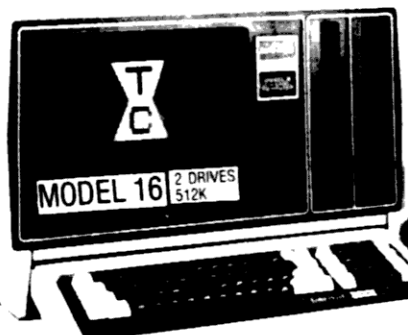
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ListMaker also splits files that become too large. This is done alphabetically. Specify the search field and the range to be included in each new file, and ListMaker takes care of the rest.

A directory is available from the main menu. However, in many sections you must enter file names without easy access to the directory, so it's helpful to keep a printout of the directory handy.

ListMaker salvages the data in a file if you must alter the file to a new format. This is an important and useful feature. It means you can add or delete fields without retyping the previous data.

The feature is a little tricky to use, but if you follow the directions carefully, it works quite smoothly. You must first create the new format, then specify the new field number for each field from the old format. You don't have to transfer all fields.

The speed with which ListMaker loads files is very poor. A file of 100 records took one minute and 25 seconds to load. A file twice that size took an incredible four minutes and 52 seconds. The 200-record file was almost at full disk capacity (222 records).

String shuffling within the computer

causes these long delays as records come from the disk. This load time is so unacceptable that most users will want to keep their file size at no more than half memory capacity.

Promise! doesn't have this problem. Initialized with a file similar to the ListMaker test file, Promise! loaded the

*"...speed differences
are very important,
as they directly affect
the ease and convenience
of program use."*

100-record file in 16 seconds, and the 200-record file in a mere 31 seconds. These speed differences are very important, as they directly affect the ease and convenience of program use.

Promise! provides a complete sorted directory from the main menu. This sophisticated option allows selection by extension (all /DAT files, for example) or by file name (all files beginning with A), and by drive number.

You can use Promise! to provide an index of all your disk directories. The necessary descriptor file already exists on the disk. This disk index even reads more than one DOS. If Promise! is on DOSPLUS, for example, you can obtain a directory of a NEWDOS disk in drive 1.

Some of the file-splitting and manipulation features that are separate functions in ListMaker are an integral part of Promise!. Because file manipulation is so easy, Promise! overcomes the usual limitations of an in-memory data base to a great degree.

For example, you have a file on customers consisting of name, address, account numbers, balance, and account status. You wish to mail an advertising flyer to all customers. Your file is divided into part I (A-M) and part II (N-Z).

With Promise! you can load only the fields you need: name and address. By loading selected fields, it might be possible to fit parts I and II in memory, which would simplify creating a zip code order sort.

An overlap option permits loading selected fields to overwrite fields in memory. For example, with fields A, B,

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C, and D in memory, you can overwrite field B with the contents of a field from another file on the disk, leaving fields A, C, and D unchanged.

You can save or load records according to any selection criteria. Since Promise! selection is very sophisticated, you can create any number of special purpose files from a master file, and simply discard them when they're no longer needed.

You can change the descriptor file, which sets up field size and type, at any time. However, any modifications can cause the data that already exists to display in the wrong fields.

To avoid this problem save the data in the special Basic format by placing commas between the field letters, then change the descriptor file as desired. Reload the data, rearranged to match the new file format. For example, you can move Field D in the old file to field A in the new file, and the data will still be exactly correct.

One of the frustrations of working with an in-memory data base is the difficulty of sorting multiple files. Suppose your customer file were in two parts as previously described. A new ad brings in 150 responses, and you need to add all these new names to the data base.

The hard way would be to load part I, type in all the new names in the range A-M, save that file, then load part II and type in the N-Z names. Probably both files would grow too large in the process, and you'd have to create a third file taken from both I and II (A-G, H-O, P-Z).

Promise! has simpler methods. One is to type in all the new names as a separate file and sort them. Then use the Merge program to create a master file, in sorted order, of the smaller files. After the three files are together, you can load them in selected pieces as needed.

Unfortunately, you can't select a portion of a master file, make changes, then save it back into the original file. Once you change data from a master file, you must save it into a new file name.

Eventually, after enough parts come off the master and go into new files, it becomes useful to create a new master file. These master files are also convenient for printouts.

Just how many records are practical with Promise!? In theory, you could handle something like 2,000 records of an average 150-byte size.

The mechanics of keeping track of 10 files, however, can be overwhelming. I would suggest a practical limit of 800-1,000 records. For ListMaker, the

limit would be much smaller, perhaps 400 records, due primarily to slow load time.

Calculations

Promise! calculations are primitive by random-access data-base standards, but quite good for a sequential data base. The calculations are available only on printouts, through CALCS3, a separate program included on the disk.

This program gives totals and subtotals on numeric fields. In addition, it produces a balance forward column and two calculated columns.

The calculated columns use a formula of your choice, adding, subtracting, multiplying, or dividing field contents or constants. The second calculated column can use the results of the first calculation in its formula.

Two calculated fields are sufficient for many business purposes, such as figuring sales tax. This is probably inadequate, however, for a complex inventory system that needs percentage discounts, markups, or formula pricing.

Remember too that these calculations occur only for the printout and the results aren't saved in the data file for later on-screen manipulation or viewing.

CALCS3 produces an attractive printout, with the left column indexed (indented) if desired when there are two or more identical entries in the first field. The program isn't difficult to use, but it doesn't retain report formats, and it's necessary to start over, defining fields and formulas, each time you use the program.

CALCS3 doesn't warn if the line length exceeds 80 characters so it's easy to define a report that's too long and then have to begin again.

The CALCS3 program is the weakest link in the new Promise!. It's unchanged from the old Aids, and it's slow and awkward to use compared to the rest of the program. According to SoftTrends, it will be rewritten soon.

Conclusion

ListMaker and Promise! are two data-base management programs that provide the same basic capabilities. But Promise!'s more sophisticated features and ease of use make it the exceptional value, especially when you consider that both packages are similarly priced. ■

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Space Maker

by Jim Barbarello

If you have trouble reading compressed Model II Basic program listings, Doculist can help by automatically inserting eye-saving spaces.

Some Basic program listings are almost impossible to read because they lack spaces between words, include several command statements on a single line, produce left-justified line numbers, and have other annoying space-saving techniques. *80 Micro* published an article ("Superlist," November 1981, p. 333) that inserted spaces into Model I/III Basic listings to solve this problem. But that left us Model II/16 owners without a solution—until now.

I call my version of Superlist Doculist. Doculist is different from Superlist in many ways, including what it does and how it works.

The Basic Interpreter

Basic is a machine-language program that loads into the Model II's memory starting at 2800 hexadecimal (hex). The computer stores Basic instructions you key in or load from a disk in a specific area of memory in a specific format. When you issue the Run command, the computer interprets the stored code and performs the requested functions.

The first problem you encounter when working on the Model II is that the start of the storage area for the Basic code isn't always the same, as it is on the Model I/III. When you call Basic, you usually specify the maximum number of buffer areas you need for disk input and output. Each buffer takes up a certain amount of memory. The start of

the Basic storage area is adjusted depending on the number of buffers you request.

Since the Basic starting point is floating, how does the Basic interpreter know where to start reading the code? The computer stores the Basic starting address at 2B4F and 2B50 hex. The first 2 bytes in the start address indicate the memory location where the subsequent program line begins (the first 2 bytes equal zero if this is the last program line). The next 2 bytes store the program line number in hex. The actual Basic code follows that and, finally, a zero byte indicates the end of the line.

This procedure continues through the remainder of the Basic code. The computer doesn't store code in full ASCII format in memory. In fact, the computer stores most Basic commands (like =, For, and REM) as 1-byte tokens. Thus, if your program contains a remark statement, that notation is stored as the 1-byte token 90 hex.

The remark statement notation is the 16th entry in a table that contains all the Basic commands, spelled out back to back. This table is part of Basic and starts at memory location 2853 hex. If you inspect the table, you can recognize the command lines except for the first letter of each. In the table, 80 hex (128 decimal) is added to the ASCII code of the first letter of each command. This flags the beginning of each command.

To locate the ASCII key word identified by the specific token, subtract 128 from the token (by zeroing bit 7) and use the remainder to count through the table. This is how Doculist reaches the beginning of the key word. The program then stores the first letter of the key word (after reconverting it to an ASCII character), and continues to read and store ASCII characters until it reaches the beginning of the next key word.

Two Basic tokens—90 hex and 92 hex—require special treatment. When you specify Else in your program, Basic stores a colon (3A hex) and then the Else token (92 hex). Basic lets you precede Else with a colon manually, also. In this instance, Basic stores 3A 3A 92, which causes Doculist to print a blank line (colon only) and start the following line with :Else. To avoid this, Doculist checks for two colons before a 92 hex and, if found, deletes one.

The other token that requires special treatment is a remark statement 90 hex. For all who thought using an apostrophe (') in lieu of a remark statement saved space, here's the real story. When you cite a remark statement, Basic stores a 90 hex. When you cite an apostrophe, Basic stores 3A 90 FF, using three times the storage space. So, Doculist checks the next byte after a 90 hex to see if it is FF. If it is, the program checks

Continued on p. 189

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the byte before 90 hex for a colon. If found, it deletes the 3A but saves the apostrophe.

Doculist places a space before and after each key word if they're not there already. It begins a new line any time it encounters a colon in the Basic code, unless the colon is within quotes or is part of a remark statement. The program right-justifies the program line numbers, making them easier to read. The printout also includes the printout date in a heading. When invoked, the program alerts you to its existence by printing DOCULIST—Press "F1" to Halt Listing on the screen. If you press the F1 key, the listing stops and the message CONTINUE?(Y/N)... appears. Pressing Y lets the listing continue, and pressing N returns you to the Basic command mode (Ready). If the printer isn't available, the message reads Printer Not Available. CONTINUE?(Y/N)... To abort the program, press the N key, or prepare the printer and press the Y

key. The program benefits are evident when you compare a normal listing (Fig. 1) with a Doculist listing (Fig. 2).

The Doculist Program

The Doculist Assembly listing (see Program Listing) contains several key points to discuss. Lines 300-380 print the title residing at F42E-F45E hex. The large blank area in the title serves as a storage area for the Date information. Lines 260-290 get this date information from TRSDOS supervisor call (SVC) 45 and store it in the blank title area. Space is allocated to store the 26-byte ASCII string of date information. However, Doculist only uses the first 12 bytes of that string. Because of this, the program prints only 51 characters where 75 characters are allotted.

The actual decoding and listing process begins at START2 (line 390). A complete line is decoded and stored in the buffer. When the program encounters a line end (zero byte), execution jumps to LINEND (line 1130), which in turn calls PRINT1. After the program

```
10 CLS: CLEAR 200: PRINT TAB(16); "8 BIT BINARY CONVERSION": PRINT
  NTSTRINGS(79,150)
20 PRINT CHR$(1); TAB(20); "Enter Number (0-255)..."; CHR$(23);: PRINT @ (ROW(0), 43);,;
30 INPUT A: IF A(0 OR A) > 255 THEN 20 ELSE NU=A
40 PRINT CHR$(2); 'Turns off cursor
50 FOR I=7 TO 0 STEP -1
60 D=AMOD2I:A(I)=1+(A<=D):A=D: 'Determine if Binary Bit I is 1 or 0
70 NEXT: IF ROW(0) > 18 THEN PRINT @ (2,0), CHR$(24);: PRINT @ (4,0);,; ELSE PRINT: REM: Whe
  n at end of screen, erase and start at top.
80 PRINT @ (ROW(0)-2,0), CHR$(23); "DECIMAL NUMBER:"; NU; TAB(32); "BINARY BIT #"
90 PRINT TAB(20);: FOR I=7 TO 0 STEP -1: PRINT USING "####"; I;: NEXT: PRINT
100 PRINT TAB(20); STRINGS(35,45)
110 PRINT TAB(20);: FOR I=7 TO 0 STEP -1: PRINT USING "####"; A(I);: NEXT
120 PRINT: PRINT STRINGS(79,46): GOTO 20
```

Figure 1. A compressed Basic listing, written without using spaces for clarity.

```
10 CLS
: CLEAR 200
: PRINT TAB( 16); "8 BIT BINARY CONVERSION"
: PRINT STRINGS( 79,150)
20 PRINT CHR$( 1); TAB( 20); "Enter Number (0-255)..."; CHR$( 23);
: PRINT @ ( ROW( 0), 43);,;
30 INPUT A
: IF A<0 OR A>255 THEN 20
: ELSE NU = A
40 PRINT CHR$( 2); 'Turns off cursor
50 FOR I = 7 TO 0 STEP - 1
60 D = A MOD 2
: A(I) = 1 + (A <= D)
: A = D
: ' Determine if Binary Bit I is 1 or 0
70 NEXT
: IF ROW( 0) > 18 THEN PRINT @ (2,0), CHR$( 24);
: PRINT @ (4,0);,;
: ELSE PRINT
: REM : When at end of screen, erase and start at top.
80 PRINT @ ( ROW( 0) - 2,0), CHR$( 23); "DECIMAL NUMBER:"; NU; TAB( 32)
: "BINARY BIT #"
90 PRINT TAB( 20);
: FOR I = 7 TO 0 STEP - 1
: PRINT USING "####"; I;
: NEXT
: PRINT
100 PRINT TAB( 20); STRINGS( 35,45)
110 PRINT TAB( 20);
: FOR I = 7 TO 0 STEP - 1
: PRINT USING "####"; A(I);
: NEXT
120 PRINT
: PRINT STRINGS( 79,46)
: GOTO 20
```

Figure 2. The same listing as in Fig. 1 after the Doculist program has inserted spaces.

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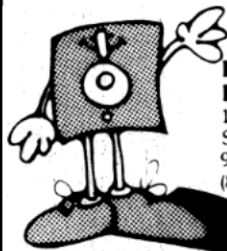
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```

TRS-80 Model II DEBUG Program
8200 21 2D F4 06 33 0E 0D 3E 09 CF ED 73 00 F7 31 00 1-..3..>...s..l.
8210 F7 DD 21 2A F4 AF DD 77 00 DD 77 01 FD 2A 4F 2B ..1*...w...w...*O+
8220 FD 22 28 F4 21 86 F4 06 00 3E 2D CF 21 60 F4 06 ..*(.....>...!...
8230 32 0E 0D 3E 13 CF C4 16 F4 41 3E 12 CF FD 2A 28 2>.....A>...*{
8240 F4 DD 21 C7 F4 FD 4E 00 FD 23 FD 46 00 FD 23 78 ..!...N...F...#x
8250 B1 CA 21 F4 ED 43 28 F4 FD 5E 00 FD 23 FD 56 00 ..!...C(......#..V.
8260 FD 23 DD E5 E1 06 00 3E 15 CF 06 05 DD 23 10 FC ..!...>.....#..
8270 3E 20 DD 77 00 DD 23 FD 7E 00 FD 23 CB 7F 20 08 >..w...#...#...

PC SP SZHPNC AF BC DE HL IX IY AF' BC' DE' HL'
2800 21FE 000000 0000 0000 0000 0000 0000 0000 0000 0000 0000
? P
DEBUG is now ON
TRSDOS READY
DEBUG
    
```

Figure 3. This is the first section of code to enter (at DEBUG ON) if you don't have an editor/assembler.

```

TRS-80 Model II DEBUG Program
8280 B7 28 54 CD E0 F2 18 EF FE 92 20 11 FD 7E FD FE ..(T.....
8290 3A 20 02 DD 2B FD 7E FF CD F6 F2 18 DA FD 7E FF :..+.....
82A0 FE 90 20 F1 FD 7E 00 FE FF 28 08 FD 7E FF CD F6 ..#.....
82B0 F2 18 11 FD 23 FD 7E FD FE 3A 20 02 DD 2B FD 7E ..#.....
82C0 FF CD F6 F2 DD 36 00 FF DD 23 FD 7E 00 FD 23 B7 ..#.....
82D0 28 05 CD E0 F2 18 F3 DD 77 00 CD 3C F3 C3 3D F2 ..#.....
82E0 FE 09 28 06 DD 77 00 DD 23 C9 06 07 3E 20 DD 77 ..#.....
82F0 00 DD 23 10 F9 C9 F5 DD 7E FF FE 20 28 0B FE 3A ..#.....

PC SP SZHPNC AF BC DE HL IX IY AF' BC' DE' HL'
2800 21FE 000000 0000 0000 0000 0000 0000 0000 0000 0000 0000
? P
DEBUG is now ON
TRSDOS READY
DEBUG
    
```

Figure 4. The second section of code to enter if you don't have an editor/assembler.

```

TRS-80 Model II DEBUG Program
8300 28 07 3E 20 DD 77 00 DD 23 F1 E6 7F 47 04 21 53 (.>..w...#...G..IS
8310 28 7E CB 7F 23 28 FA 10 F8 2B E6 7F DD 77 00 DD (...#(...+...w...
8320 23 23 7E CB 7F 20 07 DD 77 00 DD 23 18 F3 FD 7E ..#.....
8330 00 FE 20 C8 3E 20 DD 77 00 DD 23 C9 DD 21 C7 F4 ..>..w...#...
8340 CD DB F3 DD 4E 00 DD 23 79 FE 30 20 0D 0E 20 CD ..#.....
8350 B0 F3 18 EF DD 4E 00 DD 23 79 FE 22 20 07 3A 2A ..#.....
8360 F4 2F 32 2A F4 3A 2A F4 B7 79 20 19 FE FF 20 08 ..#.....
8370 32 2B F4 DD 4E 00 DD 23 3A 2B F4 FE 00 20 05 79 ..#.....

PC SP SZHPNC AF BC DE HL IX IY AF' BC' DE' HL'
2800 21FE 000000 0000 0000 0000 0000 0000 0000 0000 0000 0000
? P
DEBUG is now ON
TRSDOS READY
DEBUG
    
```

Figure 5. The third section of code to enter if you don't have an editor/assembler.

finishes printing, execution returns to START2. This procedure continues until the next line address is 00 00, indicating the end of the program. Execution then jumps to QUIT, which simply restores the Basic stack pointer and jumps to the BASIC READY prompt.

During the decoding process, if the program finds a remark token (90 hex), it stores a OFF hex in the buffer prior to the remark. The PRINT1 routine uses this to indicate that the subsequent code is part of a remark, and the program should disregard the colons.

PRINT1 requires further explanation. When called, the first 5 bytes in the buffer represent the line number in ASCII format. Lines 1690-1760 begin testing these bytes for ASCII 0, replacing these leading zeros with spaces. When the program locates the first non-zero number, it exits this routine.

Now lines 1770-2200 take over. This

routine requires two tests. First, if the program encounters quotes, it sets a flag. Until the flag is reset with a second set of quotes, the program prints all subsequent characters without further testing. Second, if the program finds a remark flag (OFF hex) in the buffer, it stores it in the remark statement. The program then disregards colons as line delimiters.

PRINT1 calls PRINT2. It keeps track of the number of characters printed prior to the last carriage return. Line 2290 sets the limit at 72 characters, including the line number but excluding the left margin indentation. Print commands at lines 2600-2650 produce the printout. If the program cannot execute a Print command, it calls the Fault subroutine which prints the Printer Not Ready message through the STOPPR (Stop Print) routine.

This subroutine also reads a one-

[illegible][illegible][illegible]

Program Listing. The Assembly-language Doculist program.

```

00010      00010
00020      00020
00030      00030
00040      00040
00050      00050
00060      00060
00070      00070
00080      00080
00090      00090
00100      00100
00110      00110
F200      00120
F200 212DF4 00130
F203 0633 00140
F205 0E0D 00150
F207 3E09 00160
F209 CF 00170
F20A ED7300F7 00180
F20E 3100F7 00190
F211 DD212AF4 00200
F215 AF 00210
F216 DD7700 00220
F219 DD7701 00230
F21C FD2A4F2B 00240
F220 FD2220F4 00250
F224 2186F4 00260
F227 0600 00270
F229 3E2D 00280
F22B CF 00290
F22C 2160F4 00300
F22F 0632 00310
F231 0E0D 00320
F233 3E13 00330
F235 CF 00340
F236 C416F4 00350
F239 41 00360
F23A 3E12 00370
F23C CF 00380
F23D FD2A28F4 00390
F241 DD21C7F4 00400
F245 FD4E00 00410
F248 FD23 00420
F24A FD4600 00430

;*****
;*          D O C U L I S T          *
;*****
;* SOURCE=DOCULIST/ASM      OBJECT=DOCULIST/CMD *
;* VERSION 1.5.....2 OCT 1982.....J.J. BARBARELLO *
;* ABSTRACT: This program creates BASIC listings *
;* in a form suitable for easy inspection and *
;* understanding. It is a Model II version of the *
;* Model I program by Morris Jones which appeared *
;* in the Nov. 1981 issue of 80 Microcomputing. *
;*****
ORG      0F200H
LD       HL,INTRO      ;POINT TO SCREEN MSG
LD       B,51          ; 51 CHAR LONG
LD       C,0DH         ; PLUS EXTRA CRLF
LD       A,9           ;PRINT IT USING SVC 9
RST      8
LD       (0F700H),SP   ;SAVE STACK POINTER
LD       SP,0F700H     ;NEW STACK
LD       IX,QUOTES     ;START OF VARIABLE STORAGE
XOR      A             ;A=0
LD       (IX+0),A       ;QUOTES=0
LD       (IX+1),A       ;CHARS=0
LD       IY,(2B4FH)     ;2B4FH HOLDS START ADDR
LD       (NXTLIN),IY    ;GET NEXT LINE'S ADDR
LD       HL,TITLE+38    ;BUFFER AREA FOR DATE
LD       B,0            ; INFO.
LD       A,45           ;TRSDOS SERVICE # 45
RST      8             ; (GET DATE INFO).
LD       HL,TITLE       ;BUFFER AREA FOR FULL
LD       B,50           ; TITLE (50 BYTES).
LD       C,0DH         ;ADD ON A C/R AND SEND
LD       A,19          ; TO PRINTER VIA SVC 19.
RST      8             ;DO IT!
CALL     NZ,FAULT      ;IF UNABLE, GOTO FAULT
LD       B,C           ;SEND ANOTHER C/R TO THE
LD       A,18          ; PRINTER VIA SVC 18 TO
RST      8             ; SKIP A LINE.
LD       IY,(NXTLIN)   ;NEXT LINE ADDR INTO IY
LD       IX,BUFF       ;DEFINE START OF BUFFER
LD       C,(IY+0)      ;LSB OF NEXT LINE ADDR
INC      IY            ;
LD       B,(IY+0)      ;MSB OF NEXT LINE ADDR

```

Listing continued

access the memory area above 0F3FF hex, you must enter the code at an accessible memory area, and then relocate the code as you dump it to disk. At this point, press the escape key and then O to turn Debug off. Finally, type the following:

DUMP DOCULIST/CMD START = 8200,
END = 84C6,RELO = F200

and press the enter key. When TRSDOS READY returns, you have a stored program called Doculist/CMD.

Using Doculist

To use Doculist, you must load it into memory, define its starting address, and then call it with the USR command. At TRSDOS READY, type LOAD DOCULIST/CMD and press the enter key. This loads the program from disk to memory. In Basic, you accomplish this by typing SYSTEM"LOAD DOCULIST/CMD" and hitting the enter key. You don't need to reload the program as long as the Model II remains powered unless you use another machine-language program that resides in memory area F200-F4C6 hex.

To define its starting address, you

Continued on p. 196

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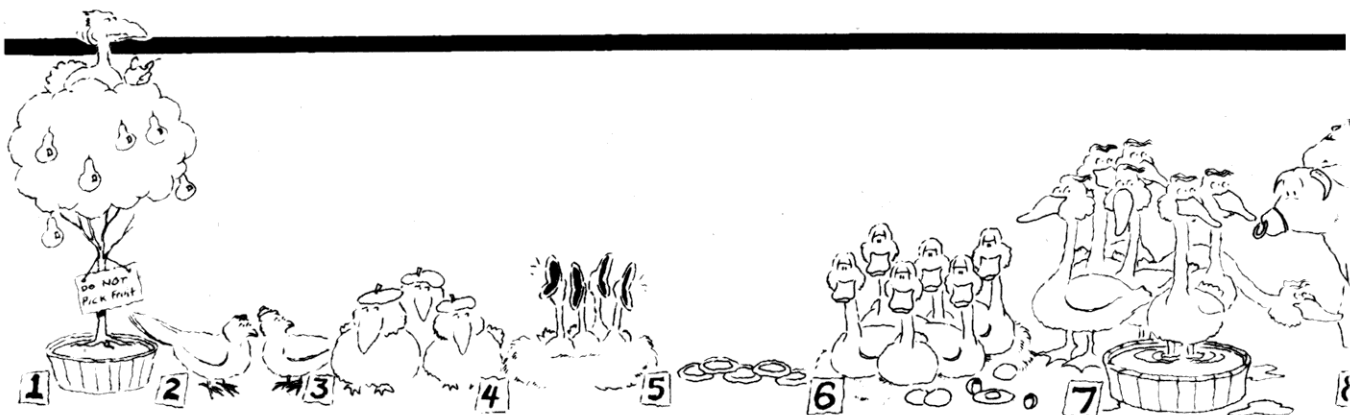
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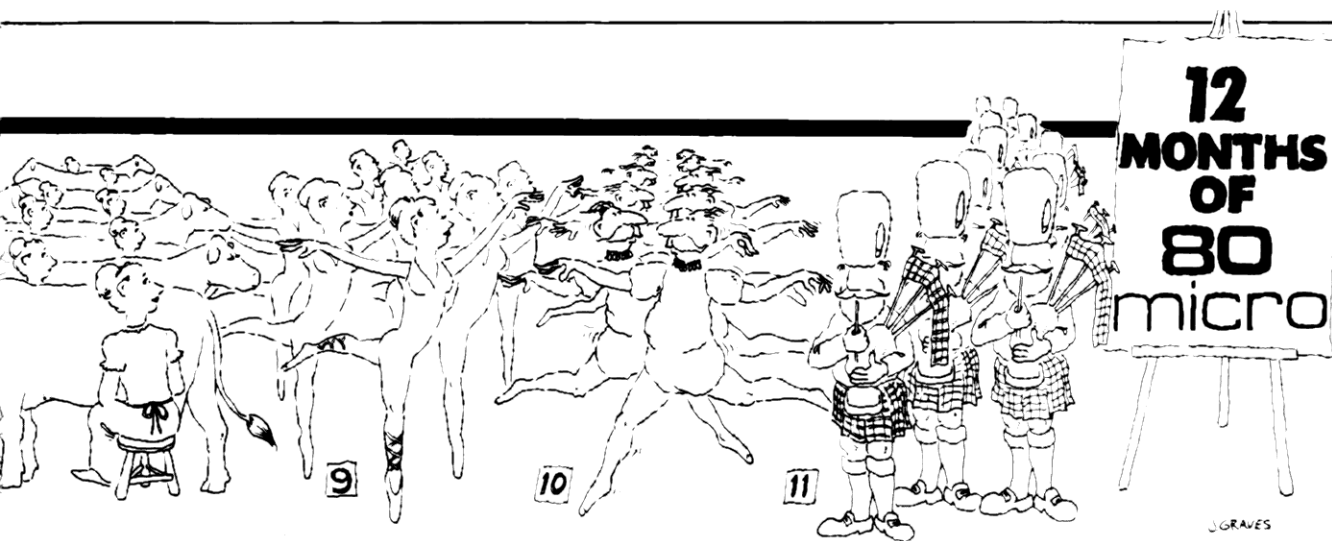
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```

F24D FD23 00440 INC IY
F24F 78 00450 LD A,B
F250 B1 00460 OR C
F251 CA21F4 00470 JP Z,QUIT
F254 ED4328F4 00480 LD (NXTLIN),BC
F258 FD5E00 00490 LD E,(IY+0)
F25B FD23 00500 INC IY
F25D FD5600 00510 LD D,(IY+0)
F260 FD23 00520 INC IY
F262 DDE5 00530 PUSH IX
F264 E1 00540 POP HL
F265 0600 00550 LD B,0
F267 3E15 00560 LD A,21
F269 CF 00570 RST 8
F26A 0605 00580 LD B,5
F26C DD23 00590 INC IX
F26E 10FC 00600 DJNZ INC
F270 3E20 00610 LD A,20H
F272 DD7700 00620 LD (IX+0),A
F275 DD23 00630 INC IX
F277 FD7E00 00640 LD A,(IY+0)
F27A FD23 00650 INC IY
F27C CB7F 00660 BIT 7,A
F27E 2008 00670 JR NZ,TOKEN
00680 ;
F280 B7 00690 OR A
F281 2854 00700 JR Z,LINEND
F283 CDE0F2 00710 CALL TAB
F286 18EF 00720 JR A2
00730 ;
F288 FE92 00740 TOKEN CP 92H
F28A 2011 00750 JR NZ,REMARK
F28C FD7EFD 00760 LD A,(IY-3)
F28F FE3A 00770 CP 3AH
F291 2002 00780 JR NZ,NCOLON
F293 DD2B 00790 DEC IX
00800 ;
F295 FD7EFF 00810 LD A,(IY-1)
F298 CDF6F2 00820 CALL SPOCK
F29B 18DA 00830 JR A2
00840 ;
F29D FD7EFF 00850 REMARK CP A,(IY-1)
F2A0 FE90 00860 LD 90H
F2A2 20F1 00870 JR NZ,NCOLON
F2A4 FD7E00 00880 LD A,(IY+0)
F2A7 FEFF 00890 CP 0FFH
F2A9 2008 00900 JR Z,APOS
F2AB FD7EFF 00910 LD A,(IY-1)
F2AE CDF6F2 00920 CALL SPOCK
F2B1 1811 00930 JR REMLIN
00940 ;
F2B3 FD23 00950 APOS INC IY
F2B5 FD7EFD 00960 LD A,(IY-3)
F2B8 FE3A 00970 CP 3AH
F2BA 2002 00980 JR NZ,APOS1
F2BC DD2B 00990 DEC IX
01000 ;
F2BE FD7EFF 01010 APOS1 LD A,(IY-1)
F2C1 CDF6F2 01020 CALL SPOCK
01030 ;
F2C4 DD3600FF 01040 REMLIN LD (IX+0),0FFH
F2C8 DD23 01050 INC IX
F2CA FD7E00 01060 REM1 LD A,(IY+0)
F2CD FD23 01070 INC IY
F2CF B7 01080 OR A
F2D0 2005 01090 JR Z,LINEND
F2D2 CDE0F2 01100 CALL TAB
F2D5 18F3 01110 JR REM1
01120 ;
F2D7 DD7700 01130 LINEND LD (IX+0),A
F2DA CD3CF3 01140 CALL PRINT1
F2DD C33DF2 01150 JP START2
01160 ;
F2E0 FE09 01170 TAB CP 09H
F2E2 2006 01180 JR Z,TAB1
F2E4 DD7700 01190 LD (IX+0),A
F2E7 DD23 01200 INC IX
F2E9 C9 01210 RET
F2EA 0607 01220 TAB1 LD B,7
F2EC 3E20 01230 LD A,20H
F2EE DD7700 01240 TAB2 LD (IX+0),A
F2F1 DD23 01250 INC IX
F2F3 10F9 01260 DJNZ TAB2
F2F5 C9 01270 RET
01280 ;
F2F6 F5 01290 SPOCK PUSH AF
F2F7 DD7EFF 01300 LD A,(IX-1)
F2FA FE20 01310 CP 20H
F2FC 200B 01320 JR Z,SP1
F2FE FE3A 01330 CP 3AH
F300 2007 01340 JR Z,SP1
F302 3E20 01350 LD A,20H
F304 DD7700 01360 LD (IX+0),A
F307 DD23 01370 INC IX
F309 F1 01380 SP1 POP AF
F30A 067F 01390 AND 7FH
F30C 47 01400 LD B,A
F30D 04 01410 INC B
F30E 215328 01420 LD HL,2853H
F311 7E 01430 SP2 LD A,(HL)
F312 CB7F 01440 BIT 7,A
F314 23 01450 INC HL
F315 28FA 01460 JR Z,SP2
F317 10F8 01470 DJNZ SP2
F319 2B 01480 DEC HL

```

Listing continued

can execute the command DEFUSR=&HF200 either in the command mode or within a Basic program. You must redefine the entry point if you leave and return to Basic or if you redefine USR0 when using another machine-language program.

To run the program, simply type X=USR(0). You can also include this command in a Basic program. When you execute X=USR(0), the screen clears and the title shown in line 2940 of the Listing appears. The first time you run the program, it accesses the disk to obtain the date information. On further runs, disk access is not performed.

If you press F1, the Listing stops at the beginning of the next line and CONTINUE ?(Y/N)... appears on the screen. The program accepts either an

*"To use Doculist,
you must
load it into memory,
define its starting address,
and then call it
with the USR command."*

upper- or lowercase Y or N. If you enter an N, you'll immediately return to the READY prompt. A Y entry resumes printing.

If printing is unable to resume, the screen message reads Printer Not Ready. CONTINUE ?(Y/N)... Again, pressing the N key returns you to the READY mode and a Y reinvokes the printing mode. This message continues until you can print again. When printing is done you return to the READY mode.

As with normal listing to the printer, it is advisable to perform a Forms set prior to calling Doculist. This allows proper paging of continuous form paper.

One Modification

For those of you with 132-column printers, a change in line 2290 is advisable. Replace the "72" (48 hex) with "124" (7C hex). This allows a longer line to be printed, but won't force a carriage return by the printer. ■

Jim Barbarello can be reached at R.D. #1, Box 241H, Tennent Road, English-town, NJ 07726. You can purchase Doculist on disk from him for \$10.

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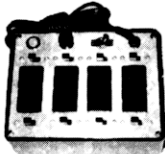
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F31A E67F	01490	AND	7FH	;MAKE IT UPPER CASE ASCII
F31C DD7700	01500	LD	(IX+0),A	; AND STORE IN BUFFER
F31F DD23	01510	INC	IX	;CONTINUE STORING TABLE
F321 23	01520 SP3	INC	HL	; ENTRIES UNTIL THE NEXT
F322 7E	01530	LD	A,(HL)	; TOKEN IS ENCOUNTERED.
F323 CB7F	01540	BIT	7,A	; THIS WILL STORE THE
F325 2007	01550	JR	NZ,SP4	; ASCII CHARACTERS THAT
F327 DD7700	01560	LD	(IX+0),A	; SPELL OUT THE COMMAND
F32A DD23	01570	INC	IX	;KEEP GOING UNTIL DONE
F32C 18F3	01580	JR	SP3	;
F32E PD7E00	01590 SP4	LD	A,(IX+0)	;IS NEXT PROGRAM CHAR A
F331 FE20	01600	CP	20H	; SPACE (20H)?
F333 C8	01610	RET	Z	;YES. JOB DONE. RETURN
F334 3E20	01620	LD	A,20H	;NO. SAVE A SPACE IN
F336 DD7700	01630	LD	(IX+0),A	; THE BUFFER. INCREMENT
F339 DD23	01640	INC	IX	; BUFFER POINTER, AND
F33B C9	01650	RET		; THEN JOB DONE. RETURN.
	01660 ;			
F33C DD21C7F4	01670 PRINT1	LD	IX,BUFF	;POINT TO START OF BUFFER
F340 CDBDF3	01680	CALL	INDENT	;SET LEFT MARGIN
F343 DD4E00	01690 A11	LD	C,(IX+0)	;GET FIRST CHAR IN BUFF
F346 DD23	01700	INC	IX	;POINT TO NEXT
F348 79	01710	LD	A,C	;IS CHAR STORED IN C
F349 FE30	01720	CP	30H	; A "0" ?
F34B 200D	01730	JR	NZ,A12	;NO. GOTO A12
F34D 0E20	01740	LD	C,20H	;YES. REPLACE WITH A
F34F CDBDF3	01750	CALL	PRINT2	; SPACE AND PRINT IT.
F352 18EF	01760	JR	A11	;GO BACK FOR NEXT CHAR.
F354 DD4E00	01770 A6	LD	C,(IX+0)	;GET FIRST CHAR
F357 DD23	01780	INC	IX	;POINT TO NEXT ONE
F359 79	01790	LD	A,C	; TO TEST IT
F35A FE22	01800 A12	CP	22H	; FOR QUOTES
F35C 2007	01810	JR	NZ,A5	;NO. GO AHEAD
F35E 3A2AF4	01820	LD	A,(QUOTES)	;YES. CHANGE
F361 2F	01830	CPL		; THE FLAG
F362 322AF4	01840	LD	(QUOTES),A	; AND STORE IT.
F365 3A2AF4	01850 A5	LD	A,(QUOTES)	;IF WE JUMPED HERE, NO
F368 B7	01860	OR	A	; QUOTES.
F369 79	01870	LD	A,C	;GET BACK CHAR. IF QUOTES
F36A 2019	01880	JR	NZ,A7	; FLAG, SKIP COLON TEST
F36C FEFF	01890	CP	0FFH	;IS IS A "REM" FLAG?
F36E 2008	01900	JR	NZ,A1	;NO. JUMP TO A1
F370 322BF4	01910	LD	(REM),A	;YES. STORE FLAG IN (REM)
F373 DD4E00	01920	LD	C,(IX+0)	; SKIP REM FLAG AND GET
F376 DD23	01930	INC	IX	; NEXT CHARACTER.
F378 3A2BF4	01940 A1	LD	A,(REM)	;IS CHAR PART OF REM LINE?
F37B FE00	01950	CP	0H	; (i.e. Not equal to zero)
F37D 2005	01960	JR	NZ,A3	;YES. SKIP COLON TEST
F37F 79	01970	LD	A,C	;NO. GET BACK CURRENT CHAR
F380 FE3A	01980	CP	3AH	;CHECK FOR COLON
F382 2816	01990	JR	Z,A8	;YES. JUMP TO A8.
F384 79	02000 A3	LD	A,C	;GET BACK CURRENT CHAR
F385 B7	02010 A7	OR	A	;NO. IS A=0?
F386 200D	02020	JR	NZ,A10	; NO. JUMP TO A10(PRINT)
F388 AF	02030	XOR	A	; YES. A=0 CLEARS FLAG.
F389 322BF4	02040	LD	(REM),A	;CLEAR REM LINE FLAG, SAVE
F38C 322AF4	02050	LD	(QUOTES),A	; QUOTES FLAG STATUS
F38F 0E0D	02060	LD	C,0DH	; AND SEND A CRLF
F391 CDBDF3	02070	CALL	PRINT2	; TO THE PRINT ROUTINE.
F394 C9	02080	RET		;RETURN
F395 CDBDF3	02090 A10	CALL	PRINT2	;PRINT THE CHAR IF <>0
F398 18BA	02100	JR	A6	;GET NEXT CHAR
F39A C5	02110 A8	PUSH	BC	;COLON FOUND, SO SAVE CHAR
F39B 0E0D	02120	LD	C,0DH	; AND PRINT A CRLF.
F39D CDBDF3	02130	CALL	PRINT2	; THEN SET LEFT MARGIN.
F3A0 3E07	02140	LD	A,7	; 7=5 (LINE #) + 1 (SPACE)
F3A2 322CF4	02150	LD	(CHARS),A	; + 1 (CURRENT CHAR)
F3A5 3E0B	02160	LD	A,11	;11=5 (MARGIN) + 6 (LINE
F3A7 CDDDF3	02170	CALL	IND1	; # AND TRAILING SPACE)
F3AA C1	02180	POP	BC	;GET BACK CHAR (COLON) AND
F3AB CDBDF3	02190	CALL	PRINT2	; PRINT IT.
F3AE 18A4	02200	JR	A6	;GO BACK FOR NEXT CHAR.
	02210 ;			
F3B0 41	02220 PRINT2	LD	B,C	;PUT CHAR IN B.
F3B1 78	02230	LD	A,B	; AND ALSO IN A.
F3B2 FE0D	02240	CP	0DH	;IS IT A CR?
F3B4 281D	02250	JR	Z,P1	;YES. GOTO P1
F3B6 3A2CF4	02260	LD	A,(CHARS)	;NO. GET CHAR COUNT.
F3B9 3C	02270	INC	A	; AND INCREMENT BY 1.
F3BA 322CF4	02280	LD	(CHARS),A	;SAVE NEW CHAR COUNT.
F3BD FE48	02290	CP	72	;FULL LINE YET?
F3BF 2016	02300	JR	NZ,P2	;NO. JUMP TO P2
F3C1 060D	02310	LD	B,0DH	;YES. SEND A CRLF TO
F3C3 CDF4F3	02320	CALL	PRINT	; PRINT ROUTINE.
F3C6 3E07	02330	LD	A,7	;7=5 (LINE #) + 1 (SPACE)
F3C8 322CF4	02340	LD	(CHARS),A	; + 1 (CURRENT CHAR)
F3CB 3E0B	02350	LD	A,11	;11=5 (MARGIN) + 6 (LINE
F3CD CDDDF3	02360	CALL	IND1	; # AND TRAILING SPACE)
F3D0 41	02370	LD	B,C	;GET BACK CURRENT CHAR
F3D1 1804	02380	JR	P2	; AND PRINT IT.
F3D3 AF	02390 P1	XOR	A	;END OF LINE. SET CHARS
F3D4 322CF4	02400	LD	(CHARS),A	; COUNTER TO ZERO.
F3D7 CDF4F3	02410 P2	CALL	PRINT	;PRINT CHAR IN B
F3DA C9	02420	RET		; AND RETURN.
	02430 ;			
F3DB 3E05	02440 INDENT	LD	A,5	;SET 5 SPACES FOR INDENT
F3DD F5	02450	PUSH	AF	; AND SAVE IT.
F3DE 3E04	02460	LD	A,4	;PERFORM SVC 4 (CHECK
F3E0 CF	02470	RST	8	; KEYBOARD FOR KEY
F3E1 78	02480	LD	A,B	; PRESSED (IF ANY).
F3E2 FE01	02490	CP	01H	;WAS 'F1' PRESSED?
F3E4 CCFDF3	02500	CALL	Z,STOP	;IF SO, GOSUB 'STOP'
F3E7 3E01	02510 IND3	LD	A,1	;CLEAR KEYBOARD OF ALL
F3E9 CF	02520	RST	8	; PREVIOUS KEYSTROKES,
F3EA F1	02530	POP	AF	; AND GET BACK A.

Listing continued

Listing continued

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F3EB 0620      02540      LD      B,20H      ;DEFINE SPACE TO BE PRINTED
F3ED CDF4F3    02550      CALL    PRINT      ;PRINT CHAR IN B
F3F0 3D        02560      DEC      A          ;ONE LESS TO PRINT
F3F1 20FA      02570      JR      NZ,IND2     ;GOTO IND2 TILL DONE
F3F3 C9        02580      RET          ; OTHERWISE, RETURN.
                02590      ;
F3F4 F5        02600      PRINT   PUSH   AF      ;SAVE CONTENTS OF A.
F3F5 3E12      02610      LD      A,18      ;SVC 18 (PRINTCHAR)
F3F7 CF        02620      RST      8          ;DO IT NOW!
F3F8 C416F4    02630      CALL    NZ,FAULT   ;IF UNABLE, GOSUB 'FAULT'
F3FB F1        02640      POP      AF      ;GET BACK CONTENTS OF A.
F3FC C9        02650      RET          ;JOB DONE. RETURN.
                02660      ;
F3FD 21B5F4    02670      STOP    LD      HL,STOP1+20 ;DEFINE CONTINUE MSG ONLY.
F400 0612      02680      LD      B,18      ;PRINT 18 CHAR MSG AND
F402 0E01      02690      STOPPR LD      C,1      ; INPUT 1 CHAR FROM
F404 11A1F4    02700      LD      DE,STOP1   ; KEYBOARD VIA SVC 12.
F407 3E0C      02710      LD      A,12      ; STORE CHAR AT STOP1.
F409 CF        02720      RST      8          ;DO IT NOW!
F40A 1A        02730      LD      A,(DE)    ;GET CHAR INPUTTED.
F40B CBAF      02740      RES      5,A      ;MAKE UPPER CASE IF NOT.
F40D FE4E      02750      CP      4EH      ;IS IT "N"?
F40F 2810      02760      JR      Z,QUIT    ;YES. JUMP TO QUIT.
F411 FE59      02770      CP      59H      ;NO. IS IT A "Y"?
F413 20EB      02780      JR      NZ,STOP   ; NO. TRY AGAIN.
F415 C9        02790      RET          ; YES, SO RETURN
F416 C5        02800      FAULT   PUSH   BC      ;SAVE BC INFO.
F417 21A2F4    02810      LD      HL,STOP1+1 ;PRINT 'PRINTER NOT READY'
F41A 0625      02820      LD      B,37      ; MESSAGE, ETC USING
F41C CD02F4    02830      CALL    STOPPR  ; 'STOPPR' SUBROUTINE.
F41F C1        02840      POP      BC      ;GET BACK BC INFO
F420 C9        02850      RET          ; AND RETURN.
                02860      ;
F421 ED7B00F6  02870      QUIT    LD      SP,(0F600H) ;RESTORE STACK
F425 C30028    02880      JP      2800H ;AND RETURN TO MODEL II BASIC
F428 0000      02890      NXTLIN DEFB 0          ;
F42A 00        02900      QUOTES DEFB 0          ;
F42B 00        02910      REM     DEFB 0          ;
F42C 00        02920      CHARS   DEFB 0          ;
F42D 1B        02930      INTRO   DEFB 1BH       ;
F42E 44        02940      DEFM    'D O C U L I S T --- Press "F1" to HALT list
F42F 20 4F 20 43 20 55 20 4C 20 49 20 53 20 54 20 20
F43F 2D 2D 2D 20 20 50 72 65 73 73 20 22 46 31 22 20
F44F 74 6F 20 48 41 4C 54 20 6C 69 73 74 69 6E 67 2E
F45F 0D        02950      DEFB 0DH       ;
F460 09        02960      TITLE   DEFB 09      ;TWO TABS PRECEED MSG
F461 09        02970      DEFB 09      ;
F462 20        02980      DEFM    'DOCUMENTATION PROGRAM LISTING -
F463 20 20 20 44 4F 43 55 4D 45 4E 54 41 54 49 4F 4E
F473 20 50 52 4F 47 52 41 4D 20 4C 49 53 54 49 4E 47
F483 20 2D 20 20 20 20 20 20 20 20 20 20 20 20 20 20
F493 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
F4A1 00        02990      STOP1   DEFB 0H       ;
F4A2 50        03000      DEFM    'Printer Not Ready. CONTINUE ?(Y/N)...'
F4A3 72 69 6E 74 65 72 20 4E 6F 74 20 52 65 61 64 79
F4B3 2E 20 43 4F 4E 54 49 4E 55 45 20 3F 28 59 2F 4E
F4C3 29 2E 2E 2E
F4C7          03010      BUFF     EQU      $          ;
F200          03020      END      $          ;0F200H
00000 TOTAL ERRORS

A1      F378
A10     F395
A11     F343
A12     F35A
A2      F277
A3      F384
A5      F365
A6      F354
A7      F385
A8      F39A      TAB2     F2EE
APOS    F2B3      TITLE    F460
APOS1   F2BE      TITLE1   F22C
BUFF    F4C7      TOKEN    F288
CHARS   F42C
FAULT   F416
INC     F26C
IND1    F3DD
IND2    F3ED
IND3    F3E7
INDENT  F3DB
INTRO   F42D
LINEND  F2D7
NCOLON  F295
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P2      F3D7
PRINT   F3F4
PRINT1  F33C
PRINT2  F3B0
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QUOTES  F42A
REM     F42B
REM1    F2CA
REMARK  F29D
RENLIN  F2C4
SP1     F309
SP2     F311
SP3     F321
SP4     F32E
SPOCK   F2F6
START2  F23D
STOP    F3FD
STOP1   F4A1
STOPPR  F402
TAB     F2E0
TAB1    F2EA

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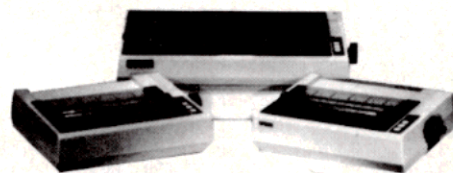
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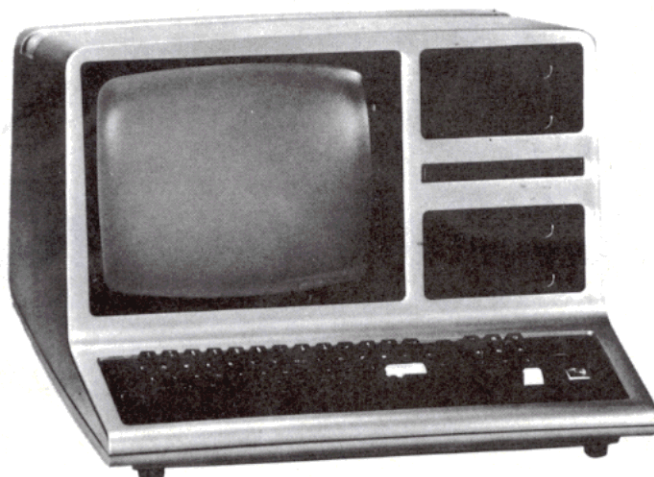
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Color Correction

by Danley E. Christensen

Although I've been pleased with my Color Computer, I've been disappointed with my color television's performance as a monitor. I've adjusted the television for normal viewing only to find its color is disastrous the next time I use it as a monitor.

To solve this problem, I needed a color bar generator—an electronic tool that produces special screen designs used to adjust the picture. Lacking such a tool, I wrote a program that serves the same purpose.

My program runs in 4K and generates

```
1 ONE HORIZONTAL BAR
2 THREE HORIZONTAL BARS
3 FIVE HORIZONTAL BARS
4 ONE VERTICAL BAR
5 THREE VERTICAL BARS
6 FIVE VERTICAL BARS
7 CROSSHATCH
8 MULTIPLE COLORED BARS
9 PICTURE CENTERING
10 END PROGRAM
```

Table 1. Design selection menu.

Get accurate color reproduction on your CoCo monitor using this color test pattern program.

vertical lines, horizontal lines, a cross-hatch, and a solid screen in any of the colors the Color Computer supports. It also creates a set of horizontal bars showing all the computer's colors at the same time; this is particularly helpful

```
1 GREEN
2 YELLOW
3 BLUE
4 RED
5 BUFF
6 CYAN
7 MAGENTA
8 ORANGE
```

Table 2. Color selection menu.

in adjusting a set's hue, tint, and brightness.

The bar generator is menu-driven. After you type RUN, the program displays the selection menu shown in Table 1. If you select options 1-7 or 9, the program displays the color menu in Table 2. The program constructs the design in the color you select and then goes into a "wait" state; it remains in this state while you use the design to adjust the television. When you're done, press any key and the menu reappears. You can make another selection or end the program. ■

Write to Danley Christensen at 17 Walnut Hills, Springfield, IL 62707.

Variable	Function
C	Color selection
K\$	Key hit
L	Print location
S	Screen type selection
X	Loop index
Y	Loop index

Table 3. Variables list.

Program Listing. Color bar generator.

```
500 CLS: PRINT
510 PRINT " 1 - ONE HORIZONTAL BAR"
520 PRINT " 2 - THREE HORIZONTAL BARS"
530 PRINT " 3 - FIVE HORIZONTAL BARS"
540 PRINT " 4 - ONE VERTICLE BAR"
```

Listing continued

The Key Box

Color Computer
4K RAM
Color Basic

```

550 PRINT " 5 - THREE VERTICLE BARS"
560 PRINT " 6 - FIVE VERTICLE BARS"
570 PRINT " 7 - CROSSHATCH"
580 PRINT " 8 - MULTIPLE COLORED BARS"
590 PRINT " 9 - PICTURE CENTERING"
600 PRINT "10 - END PROGRAM"
650 PRINT:INPUT"WHICH SELECTION (1-10)";S
660 IF S=1 THEN 1000
670 IF S=2 THEN 2000
680 IF S=3 THEN 3000
690 IF S=4 THEN 4000
700 IF S=5 THEN 5000
710 IF S=6 THEN 6000
720 IF S=7 THEN 7000
730 IF S=8 THEN 10000
740 IF S=9 THEN 11000
750 IF S=10 THEN CLS:END
780 CLS
790 PRINT "INVALID SELECTION. TRY AGAIN.": PRINT
800 SOUND 200,5
810 GOTO 510
1000 GOSUB 12000: CLS0
1020 FOR X=0 TO 63
1030 SET(X,15,C)
1050 NEXT X: GOTO 13000
2000 GOSUB 12000: CLS0
2010 CLS0
2020 FOR X=0 TO 63
2030 SET(X,8,C):SET(X,15,C):SET(X,22,C)
2090 NEXT X: GOTO 13000
3000 GOSUB 12000: CLS0
3020 FOR X=0 TO 63
3030 SET(X,1,C):SET(X,8,C):SET(X,15,C):SET(X,22,C):SET(X,29,C)
3130 NEXT X: GOTO 13000
4000 GOSUB 12000:CLS0
4010 FOR X=0 TO 31
4020 SET(31,X,C):SET(32,X,C)
4030 NEXT X:GOTO 13000
5000 GOSUB 12000:CLS0
5010 FOR X=0 TO 31
5020 SET(16,X,C):SET(17,X,C):SET(31,X,C):SET(32,X,C):SET(46,X,C)
:SET(47,X,C)
5030 NEXT X:GOTO 13000
6000 GOSUB 12000:CLS0
6010 FOR X=0 TO 31
6020 SET(1,X,C):SET(2,X,C):SET(16,X,C):SET(17,X,C):SET(31,X,C)
6030 SET(32,X,C):SET(46,X,C):SET(47,X,C):SET(61,X,C):SET(62,X,C)
6040 NEXT X:GOTO 13000
7000 GOSUB 12000:CLS0
7010 FOR X=0 TO 63
7020 SET(X,1,C):SET(X,8,C):SET(X,15,C):SET(X,22,C):SET(X,29,C)
7030 NEXT X
7040 FOR X=0 TO 31
7050 SET(1,X,C):SET(2,X,C):SET(16,X,C):SET(17,X,C):SET(31,X,C)
7060 SET(32,X,C):SET(46,X,C):SET(47,X,C):SET(61,X,C):SET(62,X,C)
7070 NEXT X:GOTO 13000
10000 CLS0
10010 C=127: L=-1
10020 FOR X=1 TO 8
10030 C=C+16
10040 FOR Y=1 TO 64
10050 L=L+1
10060 IF L<511 THEN PRINT@L,CHR$(C);
10070 NEXT Y
10080 NEXT X
10090 SET(62,30,8):SET(62,31,8):SET(63,30,8):SET(63,31,8)
10100 GOTO 13000
11000 GOSUB 12000: CLS(C): GOTO 13000
12000 CLS: PRINT
12010 PRINT TAB(10);"1 - GREEN"
12020 PRINT TAB(10);"2 - YELLOW"
12030 PRINT TAB(10);"3 - BLUE"
12040 PRINT TAB(10);"4 - RED"
12050 PRINT TAB(10);"5 - BUFF"
12060 PRINT TAB(10);"6 - CYAN"
12070 PRINT TAB(10);"7 - MAGENTA"
12080 PRINT TAB(10);"8 - ORANGE"
12090 PRINT: PRINT
12095 INPUT " WHICH COLOR";C
12100 IF C<1 OR C>8 THEN CLS: PRINT "INVALID COLOR. TRY AGAI
N.": SOUND 200,5: PRINT: GOTO 12010
12120 RETURN
13000 K$=INKEY$
13010 IF K$="" THEN 13000
13020 GOTO 500

```

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Make Your Word(s) Count

by Charles Knight

If you feel you could benefit from knowing the word count of a Scripsit file, try this valuable utility on your word processor.

While Scripsit is a great word processor, it lacks one feature: it doesn't provide a word count. Professional writers, and often students, need to know the approximate word count of an article. Sure, Scripsit counts all the characters in a document, including those within format and comment lines, but that total is useless if you need to know how many characters go to the printer.

Each word is always separated by one or two spaces, and may or may not contain punctuation. Two words can also be separated by only a carriage return or other text-boundary marker.

So, then, you can count the separations between the words instead of the words themselves, but you don't want to count consecutive word separators as more than one word. If words are set apart with a hyphen and two spaces instead of parentheses, the hyphen counts as one word. Dashed lines made up of periods, or other material entered with alternating spaces, are also counted as one word.

Scripsit allows format and comment lines, so words within these lines won't be counted. Since the greater-than sign (>) indicates both format and comment lines, should the program encounter that sign anywhere in the text, it skips to the next carriage return or boundary-marker before resuming the count. Block markers always contain this sign as part of their identification, so this program ignores all text between the greater-than sign and the concluding text boundary marker.

If you hyphenate your text, check the hyphenation blocks before running this

program if the words and characters in the block are to be counted. It is unnecessary to remove the hyphens themselves.

Header and footer blocks have their contents counted only once, even though they appear once on each page. They always have a format line within them, even if it is left blank.

To Begin

To use the program, type COUNT. Then specify the name of the Scripsit file whose words are to be counted. You must have an extension on your Scripsit file. If you use /SCR, then you don't have to enter /extension when prompted for filespec. The program adds the extension /SCR for you.

The program echoes the filespec and begins scanning the file and counting the text characters and words. The count is continuously updated; when finished, it displays the final word count and number of characters in the file.

The source code for this program is written using the EDAS editor/assembler from Misosys of Alexandria, VA. This assembler is more versatile and easier to use than Radio Shack's EDTASM as modified by Apparat.

The most obvious difference lies in the fact that multiple bytes are defined on a single line, as shown by the graphics in the sign-on message. If nothing else, this program makes possible publishing programs that would otherwise be too long for the magazine whose editorial space is at a premium. The equivalent EDTASM listing is approxi-

mately 150 percent longer. However, by changing this and the length of a few labels, you can easily adapt this listing to EDTASM.

The COM and TITLE pseudo-ops at the program's beginning can be omitted since they write nonexecutable code segments into an object file. And the DB statement must be changed to DEFB or DEFM, as appropriate; each byte in a DEFB must be on a line by itself. Except for the fact that all labels must end with a colon, I can think of no other changes required to use the Radio Shack Disk Editor/Assembler by Microsoft. Anyone with editor/assembler experience can make these changes easily.

The Program

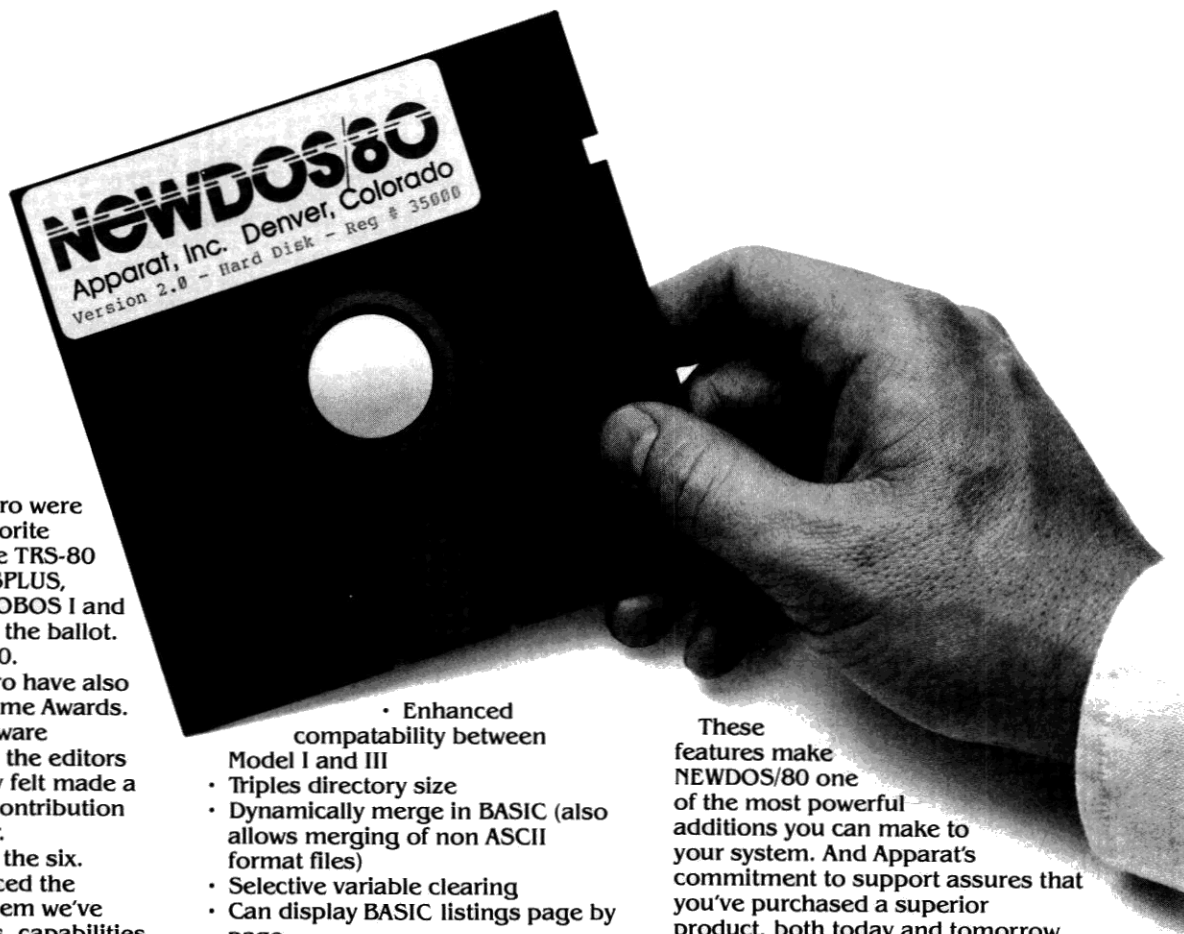
Lines 200-430 define the external routines and values used by the code. All labels beginning with "@" are external to the program; EDTASM users should omit this sign in all labels. These routines are common to LDOS, TRSDOS, and NEWDOS80 V1 and most DOSes for the Model I as well. If you have a Model III, check your operating system manual to see that these routines are in the same place. Model III users have to use a DOS other than TRSDOS because of the calls to the print routine at X'4467'. LDOS and NEWDOS support this system vector on the Model III, but TRSDOS does not.

You can write your own routine to accomplish the same thing. If you want to write an Assembly-language program doing disk I/O, you will need to know these routines. These DOS-callable routines need memory to store their data;

The Key Box

**Model I and III
32K RAM
Assembly Language
EDAS or EDTASM**

IF YOU'RE GOING TO BE PICKY ABOUT AN OPERATING SYSTEM SEE WHICH WAS PICKED BEST.



The readers of 80 Micro were asked to select their favorite operating system for the TRS-80 Model I&III. LDOS, DOSPLUS, TRSDOS, MULTIDOS, WOBOS I and NEWDOS/80 were all on the ballot. They picked NEWDOS/80.

The editors of 80 Micro have also awarded their Hall of Fame Awards. From among every software package on the market, the editors picked only six that they felt made a lasting and significant contribution to the TRS-80 computer. NEWDOS/80 was one of the six.

Since we first introduced the NEWDOS operating system we've been stating its features, capabilities and advantages. Thank you 80 Micro readers and NEWDOS/80 users for supporting us.

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 - Routing for peripheral handling
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 - Command chaining
 - Superzap to scan files
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These features make NEWDOS/80 one of the most powerful additions you can make to your system. And Apparat's commitment to support assures that you've purchased a superior product, both today and tomorrow. At just \$149.00 it could be the best investment you will make for your TRS-80.

For more information see your local computer store or contact Apparat, Inc., 4401 S. Tamarac Parkway, Denver, CO 80237, 303/741-1778.

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 **Apparat, Inc.**

✓ 40

space is saved for this by the DS (DEFS) statements in lines 210-230. SECBUF is a buffer for loading a complete data sector: FCB is a file control block needed for any open file, and UREC is a buffer for each logical record that will be

each character of the file in turn. UREC is needed only when the logical record length is a number other than 256.

DCONV, the first routine, is a binary-to-ASCII conversion routine. It decodes a 2-byte value passed to it in the

HL register pair and displays the ASCII equivalent at the current cursor position. It does so by checking the value of each digit in a table (DECTBL) and counting the number of times this value is subtracted from the count before the

Program Listing. Word Count.

```

00100 ;*****
00110 ;*** Word Count - Copyright (C) 1982 by ***
00120 ;*** Charles P. Knight 2708 Roberts Cir. ***
00130 ;*** Arlington, Texas 76010 (817) 640-4452 ***
00140 ;*** Counts words in a SCRIPSIT file V2.1 ***
00150 ;*****
0000 00160 TITLE '<SCRIPSIT Word Counting Prgm.>'
0000 00170 COM '<Copyright (C) 1982 by : >'
0000 00180 COM '<Charles P. Knight>'
5200 00190 ORG 5200H ;may be relocated
5200 C33B55 00200 START JP BEGIN ;vector to program
0100 00210 SECBUF DS 256 ;Disk I/O buffer
0020 00220 FCB DS 32 ;file control block
0001 00230 UREC DS 1 ;User record buffer
0017 00240 INBUF DS 23 ;enough for fs/ext.pw:d
4428 00250 @CLOSE EQU 4428H ;file close routine
4473 00260 @FEXT EQU 4473H ;add default extension
441C 00270 @FSPEC EQU 441CH ;move fspec to fcb
4436 00280 @READ EQU 4436H ;read logical record
4424 00290 @OPEN EQU 4424H ;file open routine
0033 00300 @DSP EQU 0033H ;ROM display routine
4467 00310 @DSPLY EQU 4467H ;DOS display routine
0040 00320 @KEYIN EQU 0040H ;ROM INPUT routine
4430 00330 @ABORT EQU 4430H ;error abort
4409 00340 @ERROR EQU 4409H ;print error message
533B 0000 00350 COUNT DW 0 ;storage for word count
533D 0000 00360 CCOUNT DW 0 ;storage for char count
007F 00370 MASK7 EQU 7FH ;mask bit seven 8D=0D!
000D 00380 CR EQU 13 ;carriage return
000A 00390 LF EQU 10 ;linefeed
0003 00400 ETX EQU 3 ;Terminator byte f/msgs
0020 00410 SPACE EQU ' ' ;ASCII space
533F 53 00420 EXT DB 'SCR' ;default extension
43 52
5342 00 00430 BACKSP DB 8,8,8,8,8,ETX ;Backspace over last cnt
08 08 08 08 03
5348 1027 00440 DECTBL DW 10000 ;Decimal conversion
534A E003 00450 DW 1000 ;table
534C 6400 00460 DW 100 ;one word for each
534E 0A00 00470 DW 10 ;possible
5350 0100 00480 DW 1 ;digit
5352 FD214853 00490 DCONV LD IY,DECTBL ;point to start of tbl
5356 AF 00500 DCONV1 XOR A ;zero A reg
5357 FD4601 00510 LD B,(IY+1) ;BC=Decimal digit
535A FD4E00 00520 LD C,(IY) ;being used
535D B7 00530 OR A ;Clear carry
535E ED42 00540 DCONV2 SBC HL,BC ;Subtract bc
5360 3803 00550 JR C,DCONV3 ;digit done?
5362 3C 00560 INC A ;No, increment count
5363 10F9 00570 JR DCONV2 ;% repeat
5365 09 00580 DCONV3 ADD HL,BC ;add it back
5366 C630 00590 ADD A,'0' ;make it into ascii
5368 CD3300 00600 CALL @DSP ;display it at cursor
536B 79 00610 LD A,C ;when C=1, we're through
536C FE01 00620 CP 1 ;so we'll go back
536E C8 00630 RET Z ;where we came from
536F FD23 00640 INC IY ;otherwise add 2 to IY
5371 FD23 00650 INC IY ;to nxt slot in dectbl
5373 18E1 00660 JR DCONV1 ;and do it again
5375 1C 00670 SIGNON DB 20,31 ;clear screen first
1F
5377 0C 00680 DB 140,140,140,140,140,140,140,140,140
8C 8C 8C 8C 8C 8C 8C 8C 8C
8C
5381 0C 00690 DB 140,140,140,140,140,140,140,140,140
8C 8C 8C 8C 8C 8C 8C 8C 8C
8C
538B 0C 00700 DB 140,140,140,140,140,140,140,140,140
8C 8C 8C 8C 8C 8C 8C 8C 8C
8C
5395 0C 00710 DB 140,140,140,140,140,140,140,140,140
8C 8C 8C 8C 8C 8C 8C 8C 8C
8C
539F 0C 00720 DB 140,140,140,140,140,140,140,140,140
8C 8C 8C 8C 8C 8C 8C 8C 8C
8C

```

Listing continued

result falls below zero. When this happens, the effect of the last subtract is reversed and the next digit is dealt with similarly. No value over 65535 is displayed because of the limitation imposed by a 16-bit byte pair, but this is no problem since Scripsit files cannot be larger than memory anyway.

The program code begins at line 1030. The sign-on message is displayed starting with the characters 28 and 31. They clear the screen like the statement, `PRINT CHR$(28);CHR$(31);` in Basic.

The routine `@DSPLY` is the DOS print routine. Text printed under this routine can contain any character except the delimiters 03 or 13. If 03 is the final byte, the cursor is positioned immediately after the last character printed; if 13 is the final character, the cursor is placed at the start of the next line. To call the routine, HL must point to the first character of the text, then `CALL X'4467'` and the message are printed beginning at the current cursor position.

The Input Statement

The display routine call described above displays the prompt message. A 03 terminator byte keeps the cursor on the same line and then a `CALL` is made

to the input routine in ROM at 0040H. To call this routine, load HL with a buffer to receive the characters, and load B with the number of characters to allow, plus one for the concluding carriage return. The routine `@KEYIN` returns whenever the enter or break key is pressed. If the break key is pressed, the carry flag is set, allowing the program to be aborted at that point, if desired. Register B, on exit, contains the actual number of characters input.

If you have a filespec, and want to open that file with a logical record length of one, first move it to a file control block to determine that it is a valid filespec. The call to `@FSPEC` does this under LDOS and NEWDOS80, and also performs any necessary lower- or uppercase conversion.

To call this routine, load DE with the address of the FCB and HL with the location for the input data. Since HL still points there from the last call, it isn't necessary to do it again. After this call, the FCB contains the filespec followed by a carriage return. The file can now be opened, but first add a default extension, if none was supplied, and print the resulting filespec on the screen.

The DOS routine `@FEXT` adds the default extension only if the user did not

supply an extension. Call this routine by loading HL with the address of the three-letter extension to be added. If fewer than three letters are to be added, they should be padded on the right with blanks. After adding the default extension, the `@DSPLY` routine is called twice: first pointing to the message "File = ", and next with HL pointing to the FCB where all characters of the file-spec, up to the carriage return, are printed.

To open the file, first put the address of the 256-byte sector buffer (SECBUF) into the HL register pair. Next, load DE with the address of the FCB. Then, load the logical record length of the file into the B register—this is zero for 256-byte LRL—and you can call the `@OPEN` routine. The zero flag is set so that the statement in line 1260 causes an abort if the file can't be opened. Since, in the event of an error, the A register already contains the error code, all you have to do is abort to `@ERROR` at 4409H, and DOS displays the proper message for you.

Up until now the DOS author has done most of the work for you. You should also have seen sufficient reason to replace that bootleg copy of XXX-DOS with a legally purchased one. After all, the better they do in the finan-

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The UPI serial printer interfaces allow an ASCII serial printer to be connected to the parallel printer port of the TRS-80 computers or any other computer which has a Centronics compatible parallel printer port.

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- 1 or 2 Stop Bits per serial word
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Listing continued

```

53A9 8C      00730      DB      140,140,140,140,140,140,140,140,140
      8C 8C 8C 8C 8C 8C 8C 8C
      8C
53B3 8C      00740      DB      140,140,140,140
      8C 8C 8C
53B7 57      00750      DB      'WORD COUNTER - '
      4F 52 44 20 43 4F 55 4E
      54 45 52 20 2D 20
53C6 66      00760      DB      'for SCRIPSIT files (C) 1982 by Charles P. Knig
      6F 72 20 53 43 52 49 50
      53 49 54 20 66 69 6C 65
      73 20 28 43 29 20 31 39
      38 32 20 62 79 20 43 68
      61 72 6C 65 73 20 50 2E
      20 4B 6E 69 67 68 74 2E
53F7 83      00770      DB      131,131,131,131,131,131,131,131,131
      83 83 83 83 83 83 83 83
      83
5401 83      00780      DB      131,131,131,131,131,131,131,131,131
      83 83 83 83 83 83 83 83
      83
540B 83      00790      DB      131,131,131,131,131,131,131,131,131
      83 83 83 83 83 83 83 83
      83
5415 83      00800      DB      131,131,131,131,131,131,131,131,131
      83 83 83 83 83 83 83 83
      83
541F 83      00810      DB      131,131,131,131,131,131,131,131,131
      83 83 83 83 83 83 83 83
      83
5429 83      00820      DB      131,131,131,131,131,131,131,131,131
      83 83 83 83 83 83 83 83
      83
5433 83      00830      DB      131,131,131,131
      83 83 83
5437 0A      00840      DB      LF,CR
      0D
5439 0A      00850 MSG1    DB      LF,'Current word count : 00000',ETX
      43 75 72 72 65 6E 74 20
      77 6F 72 64 20 63 6F 75
      6E 74 20 3A 20 30 30 30
      30 30 03
5455 0A      00860 MSG2    DB      LF,'Final word count : ',ETX
      46 69 6E 61 6C 20 77 6F
      72 64 20 63 6F 75 6E 74
      20 3A 20 03
546A 0A      00870 MSG3    DB      LF,'Final text character count : ',ETX
      46 69 6E 61 6C 20 74 65
      78 74 20 63 68 61 72 61
      63 74 65 72 20 63 6F 75
      6E 74 20 3A 20 03
5489 45      00880 INMSG    DB      'Enter the filespec of the SCRIPSIT file whose
      6E 74 65 72 20 74 68 65
      20 66 69 6C 65 73 70 65
      63 20 6F 66 20 74 68 65
      20 53 43 52 49 50 53 49
      54 20 66 69 6C 65 20 77
      68 6F 73 65 20 77 6F 72
      64 0A
54BC 63      00890      DB      'count is to be determined /SCR assumed : ',ETX
      6F 75 6E 74 20 69 73 20
      74 6F 20 62 65 20 64 65
      74 65 72 6D 69 6E 65 64
      20 2F 53 43 52 20 61 73
      73 75 6D 65 64 20 3A 20
      03
54E6 46      00900 MSG4    DB      'File ---> ',ETX
      69 6C 65 20 2D 2D 2D 3E
      20 03
54F1 49      00910 ERR1    DB      'Illegal Filespec - try again.',CR
      6C 6C 65 67 61 6C 20 46
      69 6C 65 73 70 65 63 20
      2D 20 74 72 79 20 61 67
      61 69 6E 2E 0D
550F 0A      00920 ERR2    DB      LF,'Disk read error!',CR
      44 69 73 6B 20 72 65 61
      64 20 65 72 72 6F 72 21
      0D
5521 210F55 00930 READERR LD      HL,ERR2      ;point to error message
5524 F5      00940      PUSH      AF      ;save error code
5525 CD6744 00950      CALL      @DSPLY    ;print message
5528 110353 00960      LD      DE,FCB      ;set up to close file
552B CD2844 00970      CALL      @CLOSE    ;close it
552E F1      00980      POP      AF      ;recover error code
552F C30944 00990      JP      @ERROR    ;display msg & abort
5532 21F154 01000 FSERROR LD      HL,ERR1    ;point to error message
5535 CD6744 01010      CALL      @DSPLY    ;display error msg
5538 C33044 01020      JP      @ABORT    ;abort
      01030 BEGIN:

```

Listing continued

cial department, the better off we'll be in the code department.

The next task is to display the word count message and enter the loop that individually reads each byte from the disk file and makes a decision regarding it.

To read a byte from an open file, load DE with the FCB and call the @READ routine. If the LRL is a number other than 256, you must tell @READ where to put the logical record. This value is UREC, and its address is passed to @READ in the B register. If no error occurs, the zero flag is set. If there is an error, you can test it and branch to an error-handling routine. In line 1330, you put the character from UREC into the A register and do some decision-making. (A in line 1340 sets the zero flag if the value in A is zero.) Since a Scripsit file always ends with a zero-byte, this is a way to test for the end of the file.

Other word processors, such as Lazy Writer, do not use this EOF mark of zero, so this program may not work properly with them. Also, since a Scripsit file not saved in ASCII has the high bit set on all nontext characters, you must either mask out that bit, or require the operator to save the file in ASCII. The latter is easy to circumvent. By

ANDing with 7FH, which is 01111111 in binary, the seventh bit is reset and the requirement that the file be in ASCII is gracefully avoided.

To see if you're in a format line, check for the greater-than character. If you are, call a routine, FLINE, to find the end of it without counting anything. Then see if the character is a space or anything that could be a control code, since these are separate words. If you find a space or control character, call the routine BUMPIT, which increments the word counter, and find the next byte that is not a space or control character. This keeps you from counting the five-space indent at the beginning of a paragraph as five words. The BUMPCHR routine counts each character outside a format line, thereby counting characters of actual text material.

Once the file is read, end the program. But first you want to display the final word and the final character count. The code in lines 1740-1830 does this. You should never exit a program without closing files. To close, load DE with the DCB and call @CLOSE.

There is a routine in all the popular DOSes called @CKEOF that is supposed to verify the end of the file and return the information in the flags.

Since this routine (444BH in LDOS) either varies in location or works differently among the various DOSes, I have opted for the less elegant method of checking for the EOF byte instead. Because of this, if you have a file that causes COUNT/CMD to either abort with an Input Past End error or to hang up the computer entirely, load the file back into Scripsit and save it again. Something has either happened to its EOF byte, or it wasn't a Scripsit file in the first place. This can also happen on a Scripsit file that was saved under one DOS and had its word count attempted under a different one. While you shouldn't mix DOSes or their data disks anyway, this sometimes cannot be avoided.

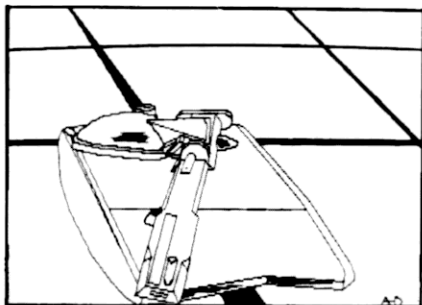
If you need a larger version of this program that not only counts words, but scrolls text across the screen, calculates average word length, and combines the counts from more than one file into a single total as well, send me \$15 and I'll send you both the source and object code on an LDOS data disk. ■

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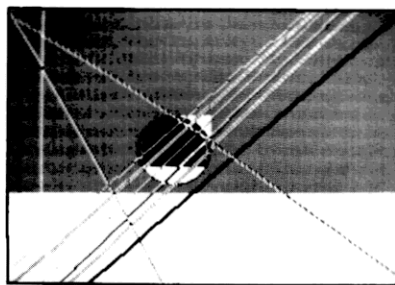


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553B	217553	01040	LD	HL,SIGNON	;point to message
553E	CD6744	01050	CALL	@DSPLY	;display signon message
5541	218954	01060	LD	HL,INMSG	;INPUT prompt
5544	CD6744	01070	CALL	@DSPLY	;print it
5547	212453	01080	LD	HL,INBUF	;input buffer
554A	0618	01090	LD	B,24	;max # chrs to INPUT
554C	CD4000	01100	CALL	@KEYIN	;get filespec
554F	D8	01110	RET	C	;terminate on break key
5550	110353	01120	LD	DE,FCB	;hl at inbuf
5553	CD1C44	01130	CALL	@FSPEC	;move it to fcb
5556	20DA	01140	JR	NZ,FSERROR	;illegal filespec
5558	110353	01150	LD	DE,FCB	;point to fcb
555B	213F53	01160	LD	HL,EXT	;point to extension
555E	CD7344	01170	CALL	@FEXT	;add default extension
5561	21E654	01180	LD	HL,MSG4	;file --->
5564	CD6744	01190	CALL	@DSPLY	;display it
5567	210353	01200	LD	HL,FCB	;point to filespec
556A	CD6744	01210	CALL	@DSPLY	;display it
556D	210352	01220	LD	HL,SECBUF	;sector buffer
5570	110353	01230	LD	DE,FCB	;point to file control bk
5573	0601	01240	LD	B,1	;LRL = 1
5575	CD2444	01250	CALL	@OPEN	;open the file
5578	C20944	01260	JP	NZ,ERROR	;abort if unsuccessful
557B	213954	01270	LD	HL,MSG1	;display word count
557E	CD6744	01280	CALL	@DSPLY	;message
5581	110353	01290	LD	DE,FCB	;file control block
5584	212353	01300	LD	HL,UREC	;buffer for character
5587	CD3644	01310	CALL	@READ	;read first record
558A	C22155	01320	JP	NZ,READERR	;disk read error
558D	3A2353	01330	LD	A,(UREC)	;put char in a
5590	A7	01340	AND	A	;check for EOF mark
5591	2856	01350	JR	Z,THROUGH	;exit if EOF
5593	E67F	01360	AND	MASK7	;Mask bit 7
5595	FE3E	01370	CP	'>'	;is it a format line?
5597	280A	01380	JR	Z,FLINE	;find next cr
5599	FE21	01390	CP	SPACE+1	;it it a space?
559B	DCBA55	01400	CALL	C,BUMPIT	;bump word cnt
559E	CD0F56	01410	CALL	BUMPCHR	;incr char count
55A1	18DE	01420	JR	GETREC	;loop through file
55A3	110353	01430	LD	DE,FCB	;point to fcb
55A6	212353	01440	LD	HL,UREC	;point to buffer
55A9	CD3644	01450	CALL	@READ	;read next record
55AC	3A2353	01460	LD	A,(UREC)	;char in a
55AF	A7	01470	AND	A	;check for EOF
55B0	2837	01480	JR	Z,THROUGH	;exit if so
55B2	E67F	01490	AND	MASK7	;mask bit seven
55B4	FE20	01500	CP	SPACE	;is is less than space?
55B6	38C9	01510	JR	C,GETREC	;return if it is
55B8	18E9	01520	JR	FLINE	;keep looking
55BA	F5	01530	PUSH	AF	;hang on to chr & flags
55BB	214253	01540	LD	HL,BACKSP	;print backspace
55BE	CD6744	01550	CALL	@DSPLY	;over old count
55C1	2A3B53	01560	LD	HL,(COUNT)	;get word count
55C4	23	01570	INC	HL	;bumpit
55C5	223B53	01580	LD	(COUNT),HL	; & put it back
55C8	CD5253	01590	CALL	DCONV	;print current word count
55CB	CDD055	01600	CALL	NONSPC	;find first non-space
55CE	F1	01610	POP	AF	;restore flags
55CF	C9	01620	RET		;return
55D0	110353	01630	LD	DE,FCB	;file control block
55D3	212353	01640	LD	HL,UREC	;record storage
55D6	CD3644	01650	CALL	@READ	;read record
55D9	CD0F56	01660	CALL	BUMPCHR	;increment character cnt
55DC	3A2353	01670	LD	A,(UREC)	;put it in a
55DF	A7	01680	AND	A	;check for EOF
55E0	2807	01690	JR	Z,THROUGH	;exit if so
55E2	E67F	01700	AND	MASK7	;mask bit 7
55E4	FE21	01710	CP	SPACE+1	;is it <= space?
55E6	28E8	01720	JR	Z,NONSPC	;yep, bump rec #
55E8	C9	01730	RET		;go back
55E9	215554	01740	LD	HL,MSG2	;final word count
55EC	CD6744	01750	CALL	@DSPLY	;display it
55EF	2A3B53	01760	LD	HL,(COUNT)	;pick up word count
55F2	CD5253	01770	CALL	DCONV	;display it
55F5	216A54	01780	LD	HL,MSG3	;final character cnt
55F8	CD6744	01790	CALL	@DSPLY	;print it
55FB	2A3D53	01800	LD	HL,(CCOUNT)	;character count
55FE	CD5253	01810	CALL	DCONV	;display it
5601	3E0D	01820	LD	A,CR	;end with cr
5603	CD3300	01830	CALL	@DSP	;print it
5606	110353	01840	LD	DE,FCB	;set up to...
5609	CD2844	01850	CALL	@CLOSE	;close the file
560C	C32D40	01860	JP	402DH	;Back to DOS
560F	2A3D53	01870	LD	HL,(CCOUNT)	;get current # chars
5612	23	01880	INC	HL	;add 1 to it
5613	223D53	01890	LD	(CCOUNT),HL	;store it back
5616	C9	01900	RET		;back where we came from
5200		01910	END	START	



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Using Unix-Xenix—Part I

by James Hawkes

This is the first installment of a new series exploring the Unix-Xenix operating system that gives 16-bit micros mainframe capabilities.

An enormous amount of Unix thunder currently exists in the microcomputer trade press, but only a sprinkling of microcomputer systems (including Radio Shack's Model 16) actually use this powerful multi-user, multi-tasking operating system. This is bound to change as micros become 16- and 32-bit machines and owners want the computational power and operating system of a mainframe. Anticipating that, I'll provide an overview of the Unix system from the perspective of a new user.

Unix, originally developed on minicomputers, is now found on mainframes and microcomputers. Because of the operating system's popularity, Unix clones are abundant: Idris, Coherent, and Unous to name a few. Microsoft calls its entry into the Unix look-alike market Xenix. Radio Shack distributes Xenix with its Model 16 under the name TRS-XENIX.

There is much to learn about the Unix operating system: over 100 utilities, a shell language, a sophisticated language called C, and the responsibilities required to maintain a multi-user environment. I'll cover each facet of the Unix system in upcoming articles, but first some pros and cons and a short history of Unix development.

Unix Pros

The Unix operating system offers a great deal of software. Its development system contains in the neighborhood of 7 million bytes of code and costs approximately \$700. Not a bad deal even though an individual user is unlikely to

use all the features the system provides.

Software written with the Unix system is portable. If you write software, then you are painfully aware of the time required to convert programs for different hardware. This problem is especially troublesome if the software is written in Basic, since most manufacturers create a dialect unique to their machines.

For example, Quant Systems just finished converting a statistical package from TRSDOS Basic to Microsoft Basic 5.0 for CP/M. This process required approximately four months of tedious and unpleasant labor even though the Basics are very similar.

For programs written in C under the Unix operating system, moving the software to another hardware configuration required only a few days' work at most. I recently heard someone from a large software house say he moved a 10,000-line program without having to make a single change. That's portability.

Because it is written in C, a structured high-level language, you can customize it and tailor the operating system commands to suit your own needs. For example, if you think a command is too cryptic to remember, you can change it in a flash. If a command doesn't exist, you can create it with existing off-the-shelf utility programs. This is vaguely similar to creating do-files in TRSDOS but better because of piping, I/O independence, and a host of programs to glue together through what is called the C shell.

Unix is a multi-user, multi-tasking

operating system. Although many micro users enjoy the independence of having their own systems, there is still a strong need, especially in business, to share data. Many still regard the time-sharing environment as the most effective means to accomplish this goal, although networking is an increasingly attractive alternative.

Excellent word processing tools are available, including programs that check grammar and literary style, as well as the more mundane spelling checkers and automatic index generators. However, one of the most exciting aspects is its ability to direct your output to a line printer or typesetter. You can set type directly on many different typesetters without modifying the text for the peculiarities of the typesetter. And since the system is designed for people who write scientific articles, the word processing capabilities also permit the representation of complex equations.

Unix Cons

Unix has gone through a number of different versions; each new version corrects perceived problems in the system. The difficulty in discussing the drawbacks of the system is that it has been commercially produced without any real standards. Thus, problems inherent in one commercial adaptation are not always problems in another.

Two of the most frequently heard complaints are the complexity of command statements and the unforgiving nature of the command interpreter. In the three operating systems I frequently use (TRSDOS, CP/M, RSTS/E), none of the command interpreters are especially forgiving if you incorrectly type in a command. As for the complexity problem, almost any system that provides enormous flexibility of operation is inherently complex to use.

Two other complaints are the lack of

system security and the lack of record and file locking. These are important considerations to potential business users. However, most commercial versions of Unix successfully address these problems.

Unix is also described as feature-laden. The package includes so much software that a potential purchaser might doubt the need for the entire package. At least one commercial vendor is unbundling the system and selling the writing tools or the Programmers Work Bench as separate entities.

Another legitimate complaint is the shortage of business software. The system, new in the business environment, will eventually receive serious attention from business software vendors.

History of Unix

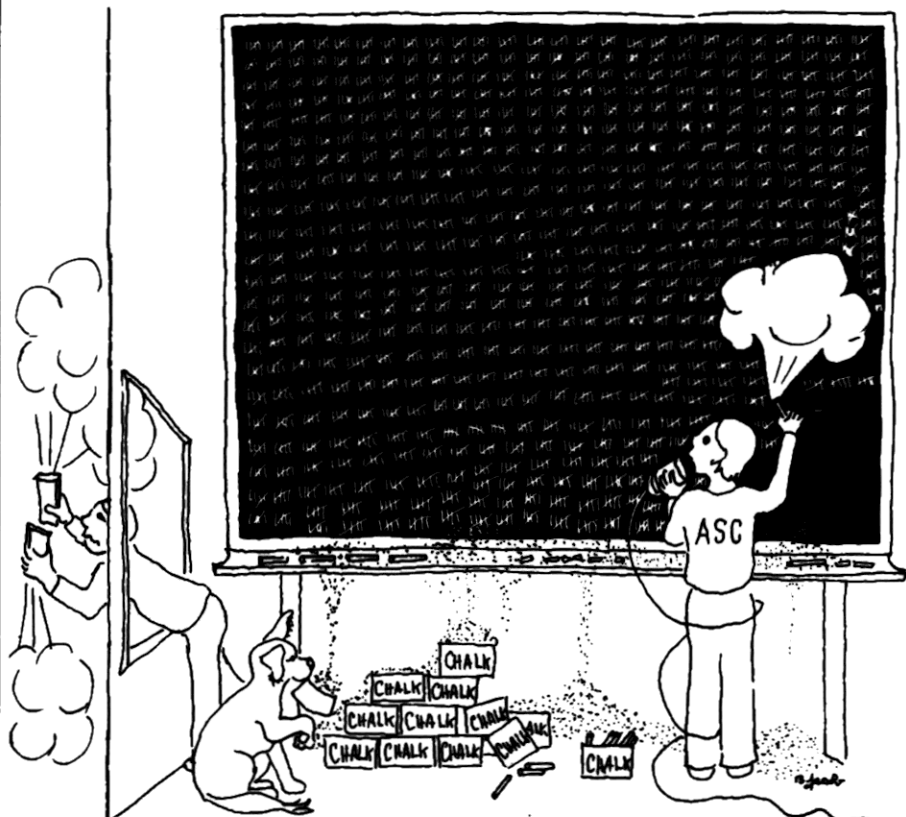
In 1969 one of Bell Labs' employees, Ken Thompson, tired of the operating system (more precisely, the lack of an operating system) he was using on the PDP-7 minicomputer. He created Unix to create a computing environment with which Bell could pursue its programming research.

At least one of Thompson's initial motives for creating Unix was the desire to implement a program to simulate movement in the solar system. Because the program required enormous amounts of time on the mainframe system, he decided to move the program to an infrequently used PDP-7. Because no programming environment existed on the PDP-7, he had to write and modify all his software on the mainframe, punch it out on paper tape, and load it into the PDP-7 for execution. If you have done any programming, you can imagine the frustration of such a climate. In his initial effort to develop tools, Thompson wrote an operating system, an assembler, and several utility programs for the minicomputer (there were no micros in 1969), and Unix was born.

Although micros had not yet arrived in 1969, the "micro spirit" was very much alive at Bell Labs. This spirit is more or less the desire to control our own computing destinies—to be free of the bureaucrat. Any user of a large system understands the frustration of not being able to use system resources when needed. It is ironic that Thompson's initial effort on a small single-user system grew into today's large multi-user Unix environment.

Thompson's colleague, Dennis Ritchie, took a language Thompson had developed, made significant modifications, and called it C. Ritchie then

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rewrote the Unix operating system in C. Thus, Unix is one of the first operating systems written in a high-level language. The system then moved to the PDP-11.

The first Unix system Bell used required about five man-years of work. It included an assembler, Fortran, and various utilities. During the initial years people at Bell wrote generic programs to help write other programs (bootstrapping at the software level). In the ensuing years Unix grew into a software colossus. I speculate that the current version of Unix required hundreds of man-years of labor.

Since 1969 the Unix system has gone through continuing improvements. In 1978 Bell Labs released version 7 and in 1981 System III. In January 1983, they announced System V.

The commercialization of Unix has been a slow process. At the beginning of this decade commercial vendors took Unix out of the academic setting and transported the system to the many architectures designed—the Motorola 68000 for one.

Xenix

Thank goodness the people at Radio Shack didn't develop their own multi-user operating system for the Model 16. Rumor has it that they tried. However, at some point they decided to let Microsoft implement Xenix on the Model 16. Everyone, including Radio Shack, will benefit from this decision.

The operating systems we now see on the Model II/12/16 pale in size and function. As previously mentioned, the Xenix development system contains around 7 million bytes of code, at least 70 times more than that on either TRSDOS or CP/M.

Xenix is Microsoft's adaptation of the Unix operating system. After Tandy "postponed" development of their multi-user system they contracted with Microsoft for a version for their Model 16. One of the problems that Microsoft and other commercial developers of Unix faced is the absence of several features—such as record and file locking, and the handling of flawed disk sectors—which are mandatory in commercial environments.

At about the same time Microsoft developed Xenix, they were also working on PC-DOS or its generic form MS-DOS. Microsoft continued development on MS-DOS and in its latest release (2.0) seems to have clearly moved in the direction of Unix/Xenix. There is even a shell language with pipes in the new MS-DOS. Microsoft's apparent intention is to make MS-DOS compatible

with the Xenix shell. This raises some interesting possibilities. Like the MS-DOS applications being very portable to Xenix and the Model 16 and vice versa. This means we should see better software in a more competitive environment, which is a boon to consumers.

Hardware Environment

Thompson and Ritchie, Unix's authors, estimated in 1979 that Unix can run on hardware costing as little as \$40,000. Things change fast in the microcomputer field. Radio Shack now offers a three-user Xenix system for about \$12,000. In addition to a Model 16 or equivalent, the Radio Shack system requires a minimum of 256K of memory and a hard disk. Some of the applications programs require the addition of a second memory board. It would not be surprising to see some manufacturer offer a 16-user box for under \$10,000 in the near future.

It is true that Unix and Xenix require a substantial amount of computing horsepower, but better horses seem to be designed every year. For Unix-like ports, Motorola's MC68000 is by far the most frequent target CPU. In fact, many compare the 68000 to Digital Equipment's VAX series of super minicomputers. Recently, Intel (80286) and National Semi Conductor (16000) introduced processors that they claim surpass the 68000's capabilities. No matter the claims and counterclaims, current 16-bit CPUs are at least in a class of the mid- and late 1970s minicomputer CPUs, and thus the operating software designed for these systems appears to be a natural transition for state-of-the-art systems.

However, there is much more to a sophisticated architecture than the CPU. Coinciding with CPU development was a significant research effort in support devices, especially in the area of memory management, floating point processors, and input/output processors offering more and more computational power for less and less money. One of the not-so-obvious reasons for this price reduction is the nonproprietary marketing effort of the integrated circuit (microchip) manufacturers. Two intelligent, hard-working individuals with sufficient background can produce a complex system architecture in a fairly short period of time, especially if the individuals have access to a sophisticated computer-assisted design work station. ■

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The **Instant Assembler** package includes six separate programs. The assembler itself includes the editor and built-in debugger. The **Linking Loader** is included in several versions for different memory sizes. A stand-alone version of the debugger (**MicroMind**) is also included. **MicroMind** can be relocated in memory and has commands to single-step, set breakpoints, display or alter registers or memory, find bytes or words, disassemble to screen or printer, convert between hex and decimal numbers, and write **SYSTEM** tapes. The **Instant Assembler** comes with a comprehensive 65 page instruction manual with many examples. Specify Model I or Model III. **TAPE INTASM 2.1** \$39.95 on tape
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Mumford Micro offers two telecommunications programs. **TELCOM I** has most of the features needed to communicate with bulletin boards, time share systems, or for file transfers between two disk-based micros over modems or direct wire. It is menu driven and extremely simple to use. Functions include transmit a disk file, receive a disk file, save received data on disk, examine and modify UART parameters, 8 programmable log-on messages, automatic checksum verification of accurate transmission and reception, and many more user conveniences. Supports line printers, lowercase characters, Xon/Xoff protocol, and programmable character keys.

TELCOM II is an expanded version of this program for the most demanding telecommunications applications. The terminal mode now has a help menu and a large printer spooler for high baud rates. From within the terminal mode you can load disk files into the memory buffer, type into the buffer, transmit the buffer, or view the buffer or data that has already scrolled off the screen. It has 10 different programmable messages that can each be sent with a single command for auto log-on or auto dialing, and 5 different character translation tables.

TELCOM II also includes an error correction file transfer mode which is compatible with the **LYNC** program available on CP/M systems and the **IBM PC**. **TELCOM II** will exchange disk files with any computer running this protocol (including another TRS-80 running **TELCOM II**), and will automatically detect and correct errors in transmission. Files can be sent to or fetched from an unattended computer. The extreme ease of use **TELCOM I** is known for has not been compromised. Reconfiguration of the programmable features is done internally from clear menus for fast, easy operation. Both versions of **TELCOM** come with complete instruction manuals, which are available separately for \$5 to help you decide which program is best suited to your needs.

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Real-World Control—Part I

by David Engelhardt

Your Model III can give Fido some real competition in keeping an eye on your house. First in a two-part series on real-world control.

A popular item in electronics stores today is the home controller—a device that lets you operate household apparatus from a central location. Model III owners already own the centerpiece of the system, the computer controller. With a real-time clock and the hardware described here, you can put your computer to work controlling a burglar alarm and sprinkler system, as well as your own real-world applications. It might just make old Fido obsolete.

This two-part article introduces a couple of ideas for a 16K Model III system that utilizes the real-world interface and real-time clock from the article "Real World, It's About Time" (*80 Micro*, March 1983, p. 342). If you have a different interface or clock, most of the information here still applies.

I include listings for each system with detailed explanations on their functions as certain parameters allow you to mod-

ify them if you require. Also included is a program called CMDTBL that lets you patch custom commands to the existing Basic command table.

This article, Part I, contains the schematic diagrams, parts list, instructions, and test program that enable you to build the hardware and test it. The application programs will appear next month in Part II.

The sprinkler and burglar alarm systems use input/output (I/O) ports to sample and control the real world via machine-language programs. I designed both systems around a constructed hardware board which I refer to as the port I/O board. I use an S-100 plug-in card as I designed the whole system around the S-100 plug-in card concept.

The S-100 card I use, made by Vector Electronics, plugs into a Wameco QMB-12 motherboard. Feel free to lay

the board out any way you like, especially if you build the circuit on something other than an S-100 card.

If you choose a different plug-in card, it is probably smaller in physical size. You can build the port I/O board using smaller cards but you must split up the total circuit. Using smaller cards does not present any problems as you can link them together using ribbon cables. You can easily adapt the required signals to your bus configuration as I label the signals in the circuit schematics.

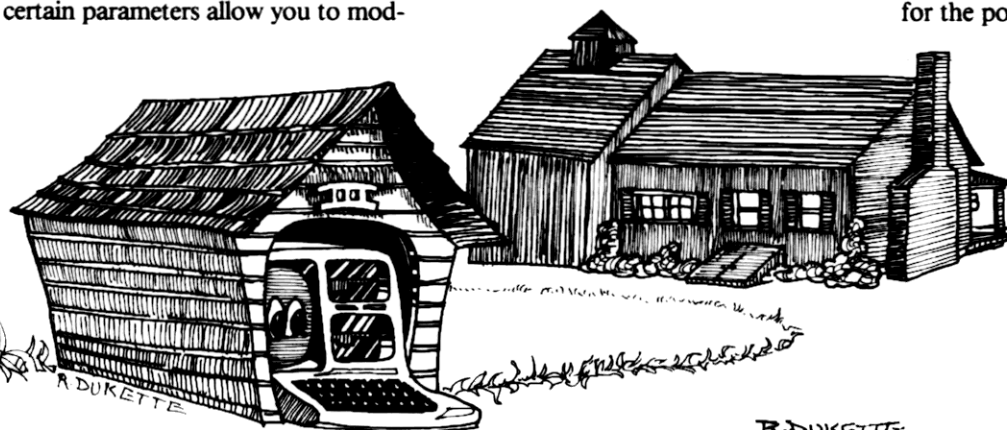
The Port I/O Board

Refer to Figs. 1, 2, and 3 for the schematics of the port I/O board. It is the heart of the system involving data I/O and control. The sprinkler and burglar alarm systems' machine-language programs control this board.

Interrupts and time control these two programs. This is where the real-time clock from the March article comes into play. It supplies the required time and interrupts needed for the two programs.

Main Decoding Section

The first and most important function of a port board is to decode the desired ports when needed. Refer to Fig. 1 for the port board's main decoding sec-



The Key Box

Model III
16K RAM Cassette Basic
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Notice the data signals on the left side of the schematic. These data lines are



The gates in Fig. 5a require synchronized reception of the appropriate signals to cause the flip-flop in U14 to switch. This flip-flop either turns on a transistor as shown or runs directly into another TTL/LS (transistor-transistor logic) device. This is up to you. I show

U14 is a dual JK flip-flop triggered by a clock pulse input from an active falling edge signal. This means that each time the output of U6b goes to a low state, the flip-flop triggers its alternate state. For this to happen, you must tie the JK inputs together to a 5-volt supply. To shut off the device send out the

same OUT 1,1 command. All 16 controllable outputs operate by this method.

Notice the resistor (R1) and capacitor (C1) in Figs. 2 and 5a. These two components initiate a power-up time delay that allows time for all of the flip-flops to reset themselves. Resetting the flip-flops on start-up requires an active low signal. At the first supply of power C1 acts like a dead short for an instant.

At this instant, all of the flip-flops reset before C1 charges up through R1 to the 5-volt power supply level. I feel this is a required feature to prevent external devices, like an alarm siren, from activating when you turn on the power.

As I mentioned earlier, you can apply the outputs of the 74LS73 flip-flops to transistors or other TTL/LS devices. Figure 5a shows relays being controlled. I use a transistor to drive the relay because the 74LS73 doesn't have the power capability to do it alone. The relays I control also control the sprinkler system zone valves and the alarm devices for the burglar alarm system.

Figure 4 is the schematic of the system relays. Notice the six outputs labeled 1-6. These are the same outputs decoded from Fig. 2. The outputs shown in Fig. 4 (with relays) pertain to port 1, with activating bits of 1, 2, 4, 8, 16, and 32. So, to turn on sprinkler zone

3, the command in Basic is OUT 1, 4. Zone 6 is OUT 1, 32. An Out command of OUT 1, 63 activates all the relays.

The activate bit table in Fig. 4 gives you an idea of what data value you need to control the designated relay. (See Table 2 for the master bit table on all I/O control.) Use spare outputs depicted at the lower-left corner for future control points.

I bought my relays from a local electronics surplus store. Potter & Brumfield manufactured the relays (part numbers R10-E1-X2-V185 or R10-E1-E2-V185). They are double-pole, double-throw (DPDT) relays. Basically, for the sprinkler system, any DPDT relay with a contact rating of at least 1 amp sufficiently covers all types of sprinkler valves.

Depending on the alarm devices you use for the burglar alarm system, rate the relay contacts for at least 2 amps. Radio Shack sells a relay that works for all the above applications and is approximately the same physical size as those I use (Radio Shack part number 275-206). These relays should carry a 12-volt rating.

Notice the diodes across each coil of the relays. The diodes eliminate most of the noise generated by the deenergized relay coil. Relay coils can generate volt-

age spikes of thousands of volts. Voltage spikes can cause major damage when induced into electronic circuits, so I highly recommend that you install diodes. Make sure you install them with reverse-biased polarity as shown in Fig. 4.

I use DPDT-rated relays for a specific purpose. To do a control to a certain relay, I need to verify whether it is on or off. I use the extra set of contacts to indicate the condition of the relay. I wire-ground one side of the relay contacts and run the other side to an input point on the port I/O input section.

Notice the close-up view of the extra set of contacts in the lower-right corner of Fig. 4. I show the extra contacts only on relay 6 but it is the same for all the relays. I will discuss more on the extra set of contacts in the input section.

Port I/O Input Section

To see what the real world is doing, you must be able to sample inputs somehow. The port I/O input section fulfills this requirement and Fig. 3 depicts this section. Since I use four ports to control the real world, I also use four ports to sample it. Sample through 74LS367 tri-state buffers that you turn on with the combination of the port value and INP (input) command.

Each port samples up to eight differ-

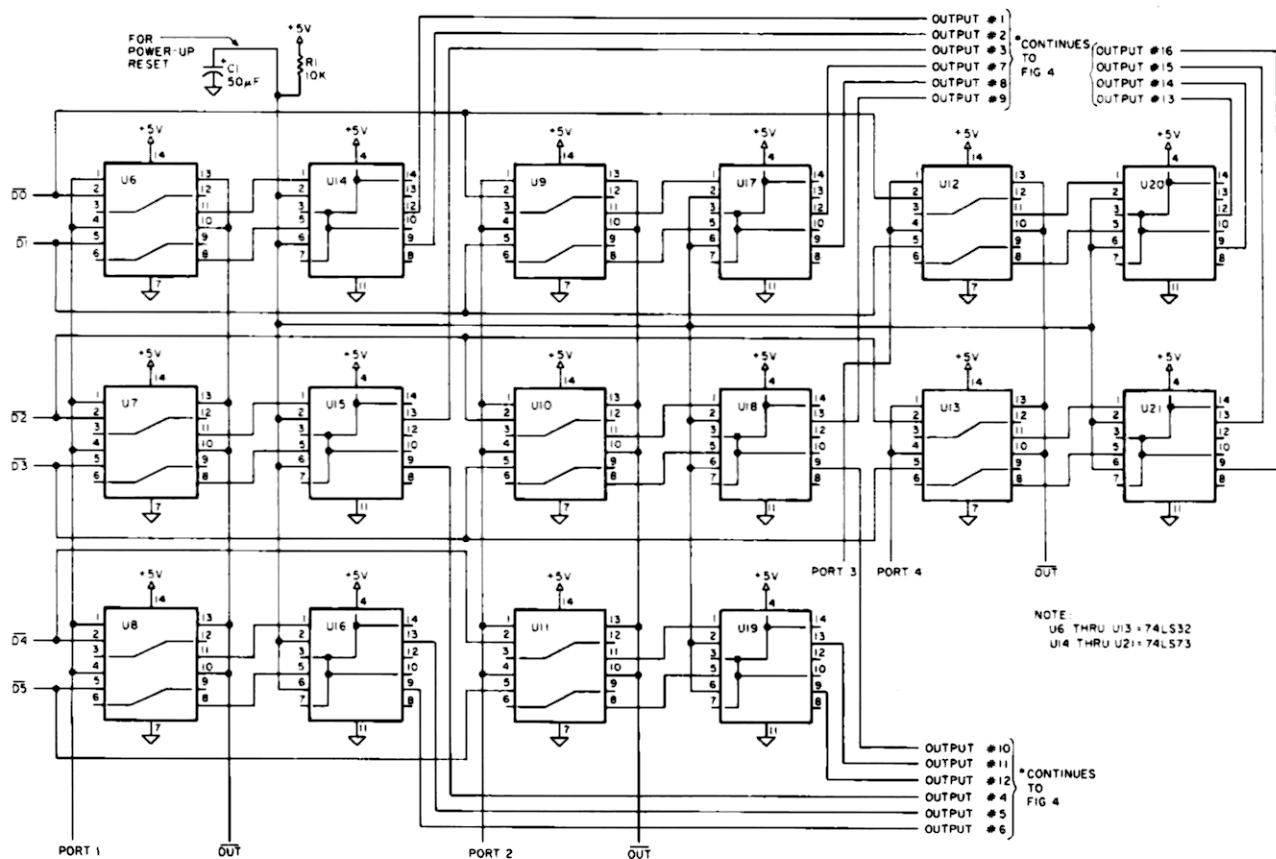


Figure 2. Port board output control section.

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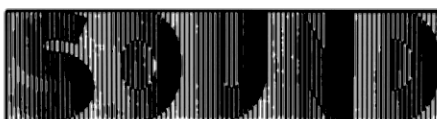


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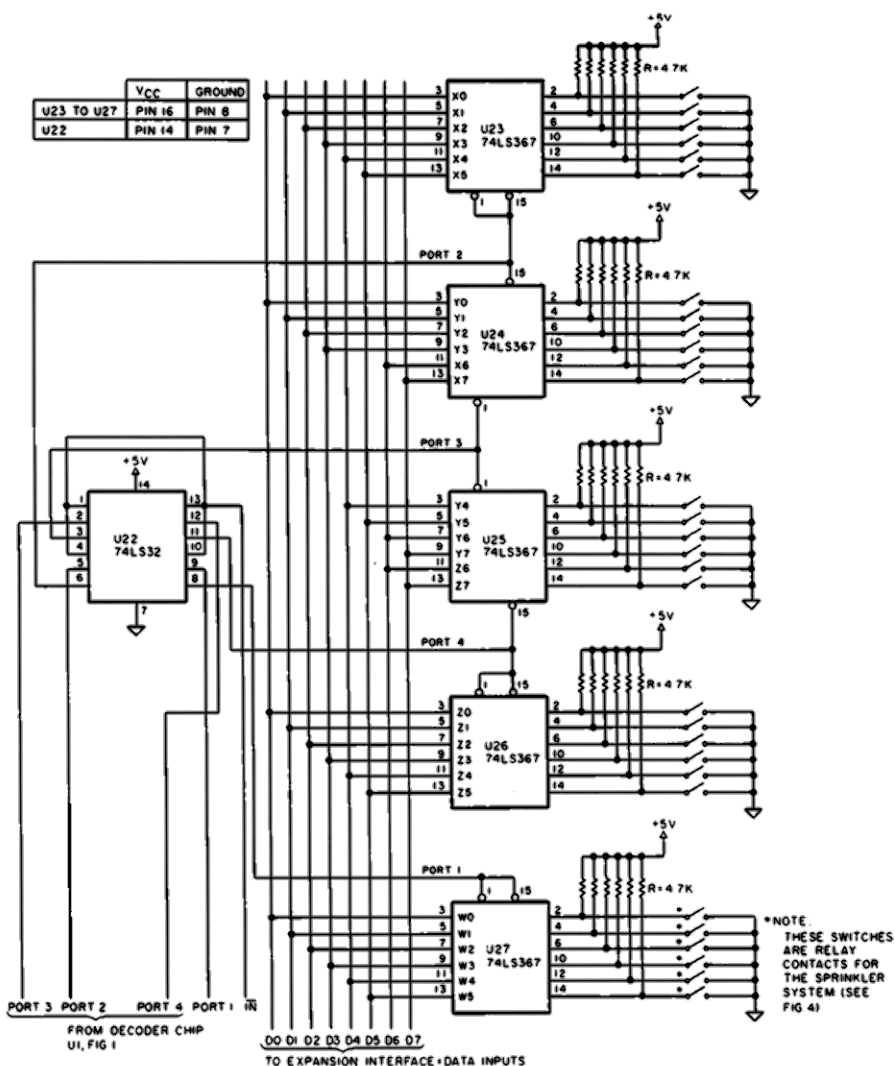


Figure 3. Port board decoded input section.

ent points with the INP command. Each 74LS367 tri-state buffer inputs six points each and splits these up between four and two input enable lines. Pin 1 enables the four-input group and pin 15 the two-input group. With a combination of 6 plus 2 and 4 plus 4, you can obtain eight inputs for each port using two chips.

Port 1 samples the sprinkler system and burglar alarm system relays. Since I currently use only six relays, I need only one tri-state buffer to obtain these external readings. Figure 3 shows this at bottom right.

The circuit works as follows: The two signals that read the ports consist of the INP command signal and the decoded port signal. Refer to Fig. 5b for a close-up view of one section of U22 in Fig. 3. The tri-state buffer requires an active low on either pin 1 or pin 15 to activate the appropriate inputs. At the coincidence of the INP and port signal, the tri-state turns on and the data line corre-

sponding to that particular input reads either a logical high or logical low.

Notice in Fig. 3 that I tie together all data lines to the computer. Since the 74LS367s are tri-state buffers, the computer only reads the activated port as all other ports are deactivated and in a high impedance state. Also notice that I label each port's input to a data line X, Y, or Z. This labeling keeps track of the inputs mixed up due to the two and six combinations.

The resistors on the tri-state gates are pull-up resistors. If you do not ground the inputs, the computer senses a logical high. In normal operation with everything off, a value of 255 (decimal) returns with an INP command.

When you close a relay or switch to ground, that data line is low and the INP value is smaller than 255. The best way to see which data line or lines you want to ground is to perform a PRINT 255-INP(X), where X is the port number. The printed value shows exactly

ACTIVATE BIT TABLE (PORT 1)						
BIT VALUE	1	2	4	8	16	32
RELAY #	1	2	3	4	5	6

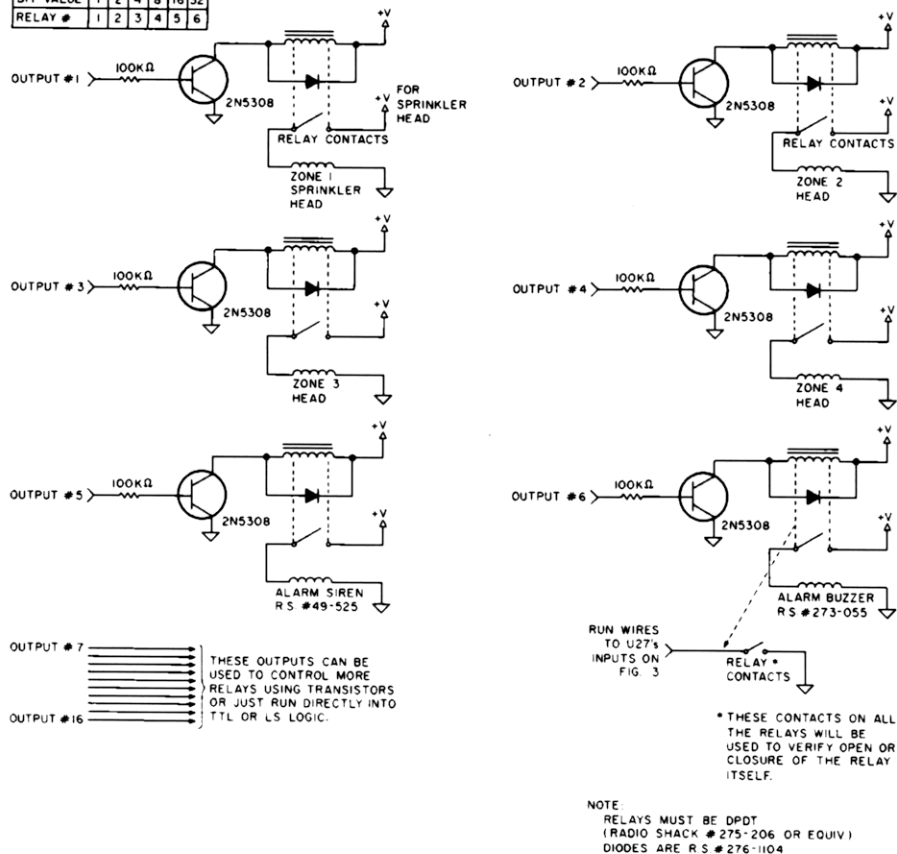


Figure 4. Sprinkler head and miscellaneous control circuitry.

what corresponding data line or lines are at ground potential.

The extra relay contacts run to U27's inputs (Fig. 3) and read the relay status of the sprinkler and burglar alarm systems. Input ports 2 and 3 sample points for the burglar alarm system. Port 4 is for future applications. I don't use port zero because the Alpha Joystick uses this port.

Here I split the functions of a port. Even though I use ports 2 and 3 for burglar alarm inputs, I can still use the out-

puts for something other than a burglar alarm system. Remember the eight possible controllable outputs assigned to each port. You can use these outputs to control a train set, or whatever, as long as there is no requirement for relay status sampling.

Port I/O Construction

Since all of the integrated circuits are either TTL or LS, don't worry about static charges as you do with CMOS chips. Refer to Fig. 6 for board layout

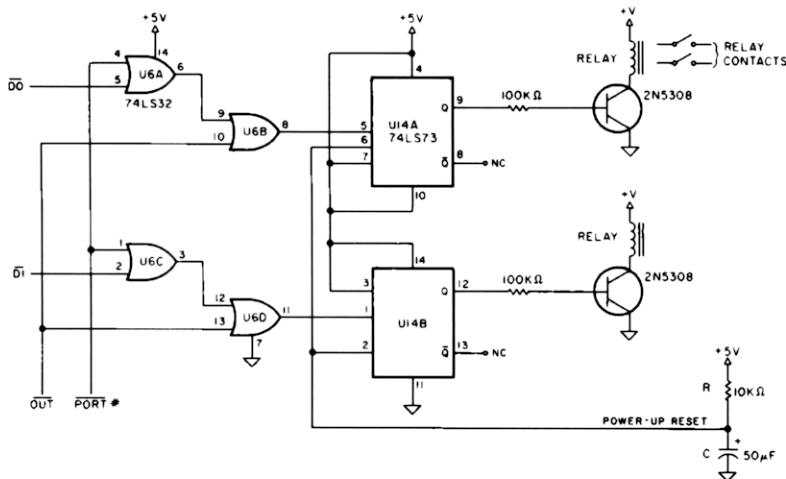


Figure 5a. Partial breakdown of output section.

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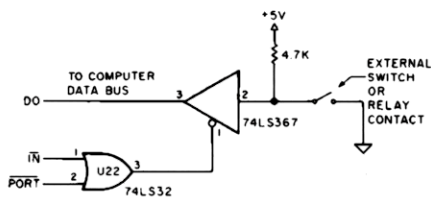


Figure 5b. Partial breakdown of input section.

and component placement. Be sure to use sockets for all integrated circuits and transistors. For hookup wire, I use wire-wrap from Radio Shack. This wire comes in various colors and is easy to work with if you use a wire stripper.

I recommend colored wire-wrap because if a problem arises with the circuitry, it is easier to troubleshoot and locate problems. It also makes construction easier. I use the blue for address lines, yellow for data lines, green for control signals, and red for power.

In regard to all of the control signals, I use the standard S-100 bus designations as my guideline. You can obtain this list from various manufacturers of S-100 products or with the purchase of the Wameco QMB-12 motherboard. If you use something other than the S-100 design, the placement of these signals is at your discretion. If you use smaller boards to construct the port I/O board, use the 16-pin DIP (dual in-line package) Jumper (Radio Shack part number 276-1976) to link the boards together.

I mounted all of the pull-up resistors (30 of them) for the port data inputs on the port I/O board. You can mount them as I did or mount them in 14- or 16-pin component carriers which look like IC sockets with no top. It is easier to mount them on the board next to the power supply. This makes it so the

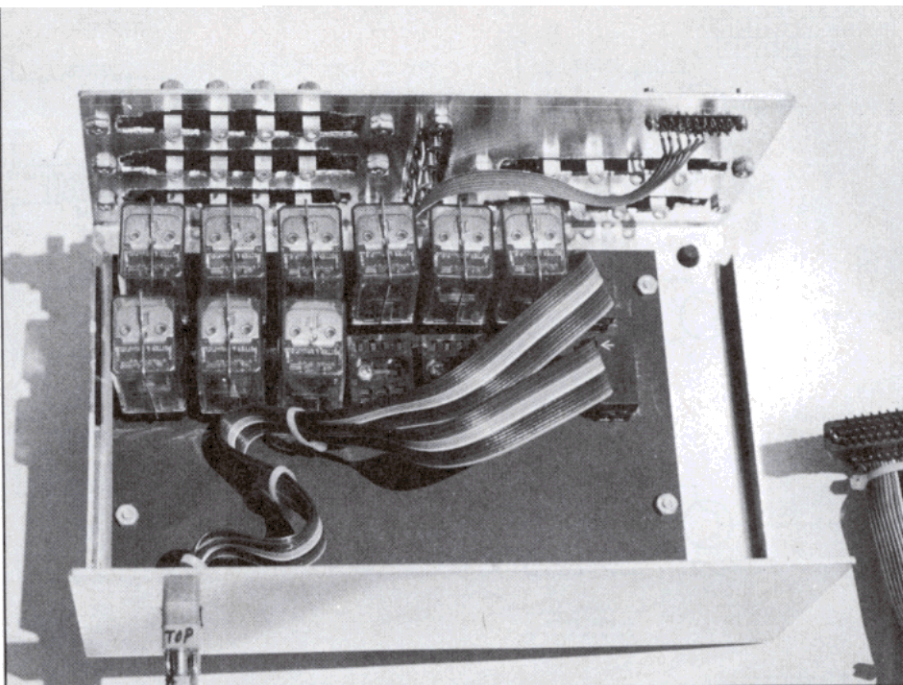


Photo 1. Relay box.

external device has only to supply a ground.

When you complete the construction, check your circuits carefully for wiring errors, opens, and shorts before you apply power to the board. If you decide to mount the 5-volt regulator on the card as I did, be sure to measure the voltage before you plug in the integrated circuits. This is a good rule to follow at all times.

If the voltage is less than 4.9 volts, add a 75 microfarad (μ F) electrolytic capacitor on the regulator's input lead. This boosts regulation to approximately 5 volts. Be sure to install .01 μ F capacitors between the power and ground pins of each integrated circuit as a filter.

Sometimes when ICs switch at high speeds, they generate noise that the .01 μ F capacitors help filter out.

Relay Box

Now that you've finished the port I/O board you must interface the relays to the port board. The cable exits the top center of the port board (labeled RC #1 in Fig. 6) and connects to the relay box as shown in Photo 1. This 14-wire ribbon cable supplies control for 12 relays, 12 volts, and ground to the relay box. I obtain the 12 volts I need for relay supply from the bus via one of the S-100 card edge connectors.

I use a 14-pin socket in the relay box as shown into which I plug the ribbon cable. Take the 12-volt line and make a common connection to one side of the relay coils for all the relays. Run each of the relay control signals from the ribbon cable to the other side of each relay coil. When you turn on the transistor, it supplies the ground needed to actuate the relay. Remember to put the noise-suppression diodes across the relay coils.

The relay contacts that I use for sprinkler control run out via two pins within the connector shown. This provides complete electrical isolation from the external hardware, especially the sprinkler system valves which operate at approximately 28 volts ac.

If you use the 12-volt supply internal to the relay box for an alarm or buzzer, you need only one output pin instead of two. For heavy current devices, I use large connectors mounted on the back

NOTE:
U6 TO U13 = 74LS32
U14 TO U21 = 74LS73
U23 TO U26 = 74LS367
Q1 TO Q16 = 2N5308

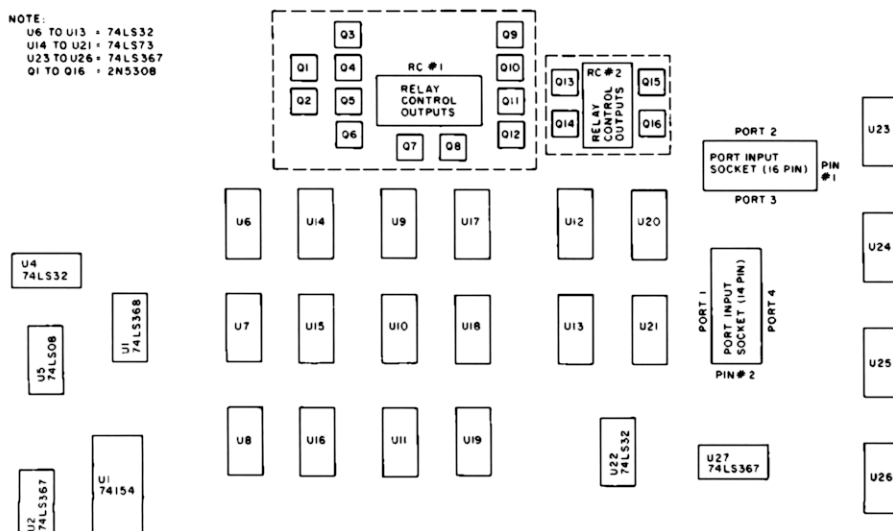
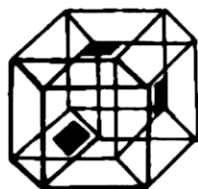


Figure 6. Port I/O layout.



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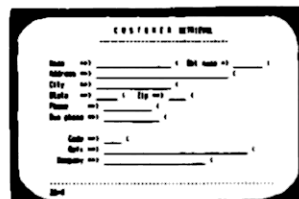
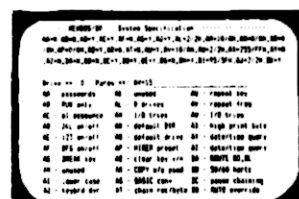
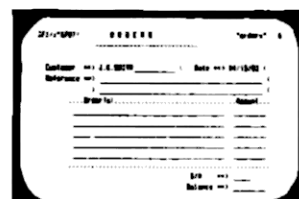
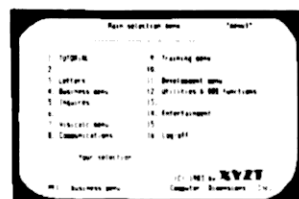
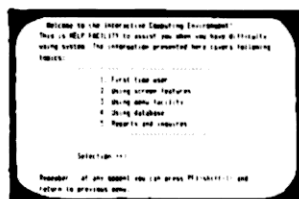
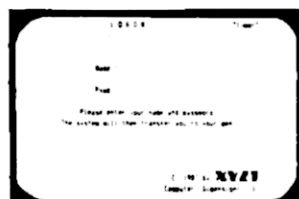
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```

10 REM **** BASIC LISTING NUMBER 1 ****
20 REM **** PORT ACTIVATE AND STATUS READ SECTION ****
30 REM
40 CLS
50 OUT236,16 ' **** TURN ON INTERNAL BUS ****
60 INPUT"ENTER PORT NUMBER = ";P
70 INPUT"ENTER ACTIVATE BIT VALUE = ";AB
80 OUT P,AB
90 FOR I=1TO10:NEXT ' **** RELAY CONTACT TIME DELAY ****
100 PV= 255-INP(P)
110 PRINT"PORT VALUE READ BACK IS ";PV
120 GOTO 60
130 REM
140 REM **** PORT INPUT TEST SECTION ****
150 REM
160 CLS
170 OUT236,16 ' **** TURN ON INTERNAL BUS ****
180 INPUT"ENTER PORT NUMBER TO SCAN UNTIL BREAK KEY IS HIT";P
190 PRINT 255-INP(P);
200 GOTO 190
210 END

```

Program Listing. Port test program.

of the relay box instead of the small connector pins. This way you can interface the relay box for external control.

I use the ground signal that runs to the relay box to sense the relay status via the extra set of contacts. Connect the ground to one side of the contacts and equalize all the relays from which you want status. I send the other side of the contacts back to the port board's input section. A ribbon cable connects the relay status inputs from the relay box and plugs into the socket labeled pin 2 in Fig. 6.

I use the socket labeled pin 1 in Fig. 6 for port 2's and 3's burglar alarm inputs. A ribbon cable plugs into this socket. The other end of this cable connects to a switch block that I use to attach the burglar alarm switches. I use barrier strips that Radio Shack sells

(part number 274-670). You can obtain these strips from electronics surplus stores as well.

I use quite a bit of ribbon cable, and I find it expensive to buy with 14- or 16-pin connectors on each end. So I purchase the connectors themselves and buy the ribbon cable from an electronics surplus store at a fraction of the retail cost. As it turns out, I can build each jumper at about one-fourth the retail price and I can make them specific lengths.

Spectra Strip manufactures self-stripping and self-locking connectors (part number 805-1401-001 for the 14-pin connector and 805-1601-001 for the 16-pin connector).

Hardware Checkout

Once you construct and hook up all

of the hardware, test it for normal operation. The Program Listing is a very short and limited Basic program that I use to test all available relays for operation. The program asks you the port number and data value to send out. The data value is the same as the activate bit that differentiates each relay control within the same port. Refer to Table 2 for the activate bit codes.

Run the Basic program and answer the port question with a value of 1. Look at Table 2 for the corresponding bit that activates the desired relay. Press the enter key and listen for the relay to switch. Read the relay port to see if the relay switches.

The time delay routine at line 90 allows time for the relay to switch. Otherwise, the INP command reads the state of the relay prior to activation. If the relay is turned on, the value read back and printed should be the same value you sent to activate the relay. Performing the same command turns the relay off and the program displays a value of zero on the screen.

Run the above test for all of the relays. Once the relay operates correctly, test the INP command for ports 2, 3, and 4. You check port 1 when you read the relay status. Run line 160 of the listing to test the INP function. If you have no grounded inputs, the value read back should be 255.

Line 190 subtracts the value from 255 to show the actual data line that is put to ground. If you tie each data line starting from D0 to D7 to ground and you lift them, one at a time, the program prints values 1, 2, 4, 8, 16, 32, 64, and 128. Run line 160 to test all the ports. The program scans the selected port until you hit the break key to stop the program. If ports 2, 3, and 4 check out, you have a totally functional port I/O board and relay box. ■

Write to David Engelhardt at 10221 W. 101st Place, Broomfield, CO 80020.

Real-World Control—Part II will cover applications programs for the controller and will appear in 80 Micro's December issue.

U1	74154	
U2,U23-U27	74LS367	
U3	74LS368	
U4,U6-U13,U22	74LS32	
U5	74LS08	
U14-U21	74LS73	
R1	10k ohm ½ watt	
C1	50 µF @ 25V electrolytic	
Caps (Filter)	.01 µF @ 25V disc	
R (Figure 3)	4.7k ohm ¼ watt	Quantity of 30
R (Figure 4)	100k ohm ¼ watt	Quantity of 6
Transistors	2N5308	Quantity of 16
Relay Diodes	R.S. #276-1104	Quantity of 16
Relays (16)	R.S. #275-206 or equivalent	
Siren	R.S. #49-525	
Buzzer	R.S. #273-055	
Misc:	Suitable enclosure for the relays, wire-wrap, IC sockets, hardware, PC board, ribbon cable with connectors.	
If used:	Wameco QMB-12 motherboard Vector 8802-1 S-100 card	

Table 1. Port I/O board and relay parts list.

		Activate Bits					
		1	2	4	8	16	32
Port 1	#1	#2	#3	#4	#5	#6	
Port 2	#7	#8	#9	#10	#11	#12	
Port 3	#13	#14					
Port 4	#15	#16					

Note: #'s refer to control output numbers in Fig. 2.

Table 2. Master activate bit table.

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Jerry W. O'Dell, Ph.D., is a psychology professor at Eastern Michigan University. He has published many articles, including several in **80 Micro** and the **Encyclopedia for the TRS-80**.

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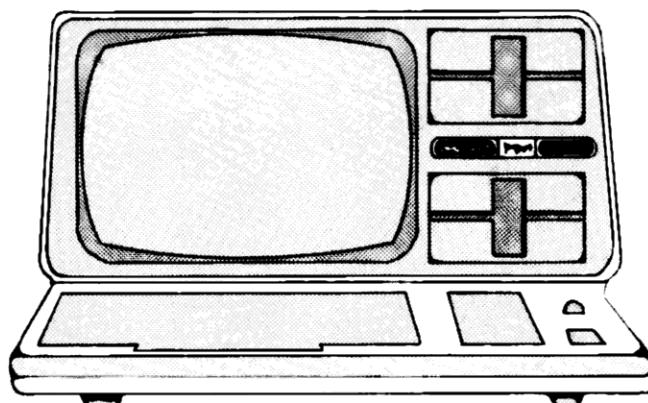
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Basic, Faster and Readable—Part III

by John Corbani

(The first two parts of this series appeared in June, p. 104, and July, p. 200.—Eds.)

Basic loops are among the most elementary of programming techniques, yet they seem to cause a lot of confusion. An inefficiently designed Basic loop deprives the user of the technique's full time-saving potential. This month I'll explain how you can use loops to improve program speed and flexibility.

In general, loops are sections of code that repeat according to some predetermined set of conditions. The conditions can be the number of times through the loop or any Boolean test (where the operators =, >, and < are applied to variables or constants).

Loops that execute based on the number of iterations have the form:

```
(1) 10 FOR A=0 TO 5
    20 PRINT A
    30 NEXT A
    40 PRINT "ENDING VALUE IS" A
    50 STOP
```

Line 10 defines the value of variable A at the start of loop execution. Unless otherwise specified in the For statement, the loop's step increment is one and the polarity positive.

Line 20 performs any useful function. If the purpose of the loop is only to mark time, you don't have to have an operand in this line.

Line 30 increments the loop variable using the indicated step and compares A to the limiting value. If the loop has not exceeded its limit, line 30 continues exe-

Improve the speed and flexibility of your Basic loops with these simple, time-saving tips.

cution at the end of the For statement in line 10. Naming the loop variable in line 30 isn't necessary, but it's a good practice when you nest many loops and might get confused.

When the program satisfies the conditions of the loop, program flow proceeds to the statement following the Next command. The loop variable (A here) maintains its last value. When program execution reaches line 40 in the above example, the value of A is 6.

The listing below illustrates an alternative form of the same loop when written in one line to count backward. The final value of A in this case is -1.

```
(2) 10 FOR A=5 TO 0 STEP -1: PRINT
    A: NEXT: PRINT "ENDING
    VALUE IS" A: STOP
```

The second Basic type of loop has the form:

```
(3) 10 A=0
    20 PRINT A
    30 A=A+1: IF A<5 THEN 20
    40 PRINT "THE ENDING VALUE
    IS" A
    50 STOP
```

This loop performs the same function as the first example, but it does so more slowly. In loops 1 and 2, Basic For...Next statements allow the program to count and compare at machine-language speed. This is at least an order of magnitude faster than the interpreted version in example 3. The advantage of loop 3 is that you can perform non-numeric tests.

The example below illustrates a keyboard polling loop using A\$ as the test variable.

```
(4) 10 A$=INKEY$:
    IF A$="" THEN 10 ELSE
    IF A$<>"B" THEN 10 ELSE
    PRINT A$: GOTO 10
```

This loop performs one or two tests on A\$ and prints a B if A\$ is a B. No matter what the character, execution loops back to the start of line 10. This kind of loop allows unlimited testing and break-out at any point in the loop.

Breaking Out of a Loop

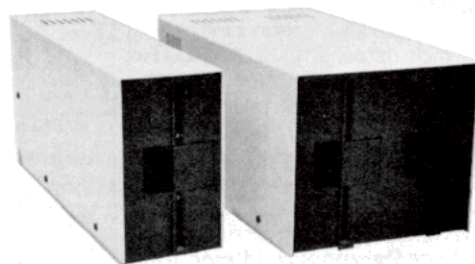
You shouldn't leave a For...Next loop in the middle of its count. You gain extra speed by storing all the loop information in an area of memory called the stack. The program removes data in the stack after executing the final Next of the loop. If the loop never reaches its natural end, that data remains in memory. If you have enough of these leftovers, they can fill memory completely, crashing your program.

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break out of a For...Next loop, but you have to know how to do it properly.

The example below provides for a timed response to the Go command.

```
(5) 10 PRINT "GO": FOR A=0 TO 100
    20 AS=INKEY$: IF AS<> "" THEN
        A=101
    30 NEXT
    40 IF A=102 THEN PRINT "FAST"
        ELSE PRINT "SLOW"
```

This loop increments A at every Next to provide timing. If A exceeds 100, the loop clears the stack at line 30. A can reach its final value by incrementing according to the instructions in line 10 or by being jumped to a high value as in line 20.

The value of A determines how the program terminates the loop. Using the loop variable to determine multiple exits can sometimes save many variables.

A companion technique provides an indefinite loop with a quick escape:

```
(6) 10 PRINT "GO": FOR A=0 TO 1
    STEP 0
    20 AS=INKEY$: IF AS<> "" THEN
        A=4
    30 NEXT
    40 PRINT "FINALLY OUT"
```

A loop like this saves you from writing a lot of GOTO statements in a complex parsing routine. To use it, set A to a series of integers starting at 1 and use the statement ON A to point to subroutines as required.

Loop Tests and Execution Speed

All of the examples given so far make their final loop test at the end of the loop. All programs execute at least once, even if the controlling variable exceeds the limit at the start of the routine. This causes undesirable consequences in some instances, but the solution is simple: Instead of putting a loop test in the body or at the end of a loop, make your tests before the loop executes to determine whether or not the loop is necessary to the program. Loop 7 runs much faster than loop 8 for any value of B:

```
(7) 10 IF B>100 THEN 40 ELSE FOR
    A=1 TO 10
    20 PRINT AS(A)
    30 NEXT
    40 STOP
```

```
(8) 10 FOR A=1 TO 10
    20 IF B>100 THEN A=20 ELSE
        PRINT AS(A)
    30 NEXT
    40 STOP
```

Speed is always the name of the game in interpreted software, and the variables used in the loops and in the various tests can make a big difference. The fastest loop possible consists of a single-line program using a single-character integer variable counting with an implied step of one.

Loop 9 illustrates this principle.

```
(9) 10 FORA%=1TO10:NEXT
    20 FOR A=1 TO 10: NEXT
    30 FOR AB#=BC TO DE STEP 1.5
    40 NEXT AB#
```

Line 10 is the first to call A%, an integer variable. It occurs at the top of the variables list and is available immediately. The small integer limits convert as quickly as most interpreters can find a variable in a variables list. Here I've eliminated all spaces and combined the entire loop into a single statement.

A program processes line 20 more slowly because A is the second variable in the variables list and is single-precision.

Lines 30 and 40 are slower yet, with two-character, double-precision variables. I use a floating point number for the step size, include a lot of variables, and extend the loop over two lines.

The loop itself may be responsible for only a small part of the total time delay involved in executing a routine. Test sequences are critical. Use as many characters in a test line as possible, and work from the most probable to the least probable result. Use If...Then... Else statements wherever possible. As indicated above, design loops so that you can break out of them as fast as possible. The loop below illustrates a routine that handles yes/no replies easily.

```
(10) 50 PRINT "PRINTOUT(Y/N)":
    GOSUB 100
    60 ON A% GOTO 80, 90
    70 PRINT "TIMED OUT": STOP
    80 PRINT "PRINTING": STOP
    90 PRINT "NO PRINT": STOP
    100 FOR A%= -500 TO -1
        AS=INKEY$:
        IF AS="" THEN 120 ELSE
            IF AS="Y" OR AS="y" THEN
                A%=0 ELSE
                IF AS="N" OR AS="n" THEN
                    A%=1
    120 NEXT: RETURN
```

Line 50 prompts you, line 100 sets up a fast loop, line 110 wastes no time on unnecessary tests, and line 120 increments everything one last time and returns.

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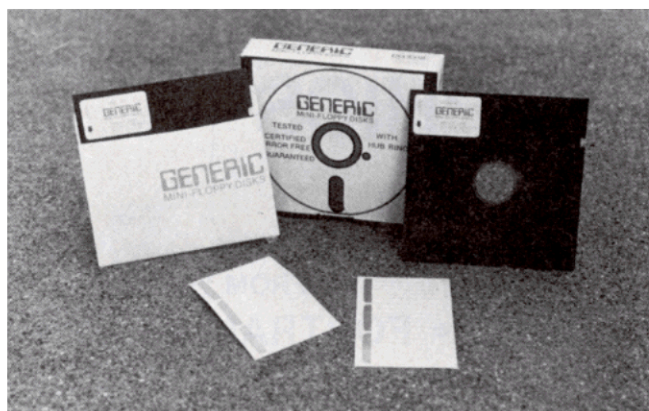
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Line 60 lets the program fall through on zero, and shunts the program to line 80 or 90 if the variable is 1 or 2. This loop provides a clean and fast timed response.

Finally, you can use the speed inherent in a loop to reduce the time necessary in performing conventional math functions. Say you want to use POKE graphics to draw a vertical line from the third character in the first screen line to the third character in the 15th line. Let YS=1 and YF=15 (start and finish). XP delineates the X position. S is the address of the upper left corner of the screen and VL is the character code for a vertical line.

The listing below shows the variations.

```
(11) 10 CLS: DEFINT A-Z: YS=1: YF=15:
      20 XP=3: S=15360: VL=191
      30 FOR Y=YS TO YF: POKE S+
      40 XP+(Y-1)*64,191: NEXT
      50 XP=5
      60 X=XS+S: FOR Y=X+(YS-1)*64
      70 TO X+(YF-1)*64 STEP 64:
      80 POKE Y,191: NEXT
      90 GOTO 50
```

Line 40 performs two multiplication functions; line 20 involves 15.

Line 30 moves XP so you can see the

difference in execution time when you run the program. You can watch line 20 draw the line one character at a time. Line 40 displays the line in one piece. Take full advantage of the range of starting, ending, and step values and all three variable precisions.

Using Next Statements

Deciding the number and position of Next statements can be complicated. Basic allows multiple Next statements within a single loop. This can make life easy or it can make debugging a program almost impossible. Loops 12 and 13 below illustrate this.

```
(12) 10 PRINT "HELLO.": FOR A=1 TO
      20 1000
      30 IF A=500 THEN PRINT "HOW "
      40 ;; NEXT ELSE IF A=750 THEN
      50 PRINT "ARE "; NEXT ELSE
      60 NEXT: PRINT "YOU ?"; INPUT
      70 AS

(13) 110 PRINT "HELLO.": FOR A=1 TO
      120 1000
      130 IF A=500 THEN PRINT "HOW "
      140 ;; ELSE IF A=750 THEN PRINT
      150 "ARE ";
      160 NEXT: PRINT "YOU ?"; INPUT
      170 AS
```

Line 20 runs, but it's confusing to read and contains more characters and tests than required to perform the timed printing of the greeting. Lines 120 and 130 run faster, are shorter, and illustrate program logic.

When you nest loops, each variable can have a Next, or if program structure allows, a single Next can control multiple loops. The listing below illustrates the choices.

```
(14) 10 FOR X=1 TO 5: FOR Y=1 TO 30:
      20 SET(X,Y): NEXT: NEXT
      30 FOR X=6 TO 10: FOR Y=1 TO
      40 30: SET(X,Y): NEXT X: NEXT Y
      50 FOR X=11 TO 15: FOR Y=1 TO
      60 30: SET(X,Y): NEXT X,Y
```

All three variations run at about the same speed. Line 10 is the shortest and fastest line.

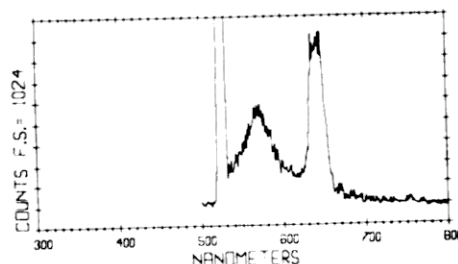
Remember that Basic words are stored as 1-byte tokens. The program interprets them in this form so that adding arguments actually slows execution down.

That's enough on loops for this session. Next month I'll take a close look at variables. ■

Write to John Corbani at 2455 Calle Linares, Santa Barbara, CA 93109.

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Scrambled Alphabets: Cryptology—Part V

by Karl Andreassen

Be cryptic: With transposition ciphers you can create secure messages in patterns only your intended receiver can recognize and decode.

Two basic types of cipherkeys are used to construct cryptograms: substitution ciphers and transposition ciphers. In the first four articles in this series (*80 Micro*, Anniversary Issue 1983, p. 530; February 1983, p. 244; April 1983, p. 291; June 1983, p. 190) I dealt with substitution ciphers, and will return to them again. Because both types are sometimes used in the same ciphertext message, you should become acquainted with transposition cipher types and methods of analysis, so your computer can help in the tasks of creating useful ciphers and deciphering those of unknown key.

Transposition methods retain, but

scramble, the message's original letters into other-than-normal sequences within the sentence, according to a pattern understood by sender and receiver. In contrast, substitution types replace each plaintext letter with a different letter or symbol. Of the two types, transposition ciphers are probably a bit more difficult to manipulate when the key is unknown, particularly when writing a program to assist in discovering the key to an unknown ciphertext.

The Alpha and Omega

If you store all letters composing a message in RAM as variables and pull them out one by one at random for serial

placement on a line, you generate a communication that is as cryptic for the sender as it is for the receiver, and is infinitely difficult to decipher. The opposite end of this extreme is a message in plain language, sent with no attempt to conceal its meaning from anyone. Somewhere between is the happy medium, an amount of concealment that satisfies the needs of both parties, with a logical pattern that enables the receiver to decipher the message in a minimum amount of time.

Randomness infers that a resulting ciphertext message has no discernible pattern, while plain language results from applying a highly complex pattern called spelling and grammar. The intelligence within the spelling and grammar carrier is retained as an increasing degree of patterned alteration of the original plain language occurs during the enciphering process. The form becomes less and less recognizable, until the needs of both parties are met at some point prior to a purely random change.

Beginning amateur and professional cryptologists tend to program greater intricacy than necessary into a cryptogram. A professional approach is to assume that someone will intercept the encrypted message, discover the pattern of alteration, and restore the carrier to plain language sooner or later. All that

```
THEREISAKEY  THTTN  HIHRY  EDTEO
HIDDENBENEA RDHPU  EEELR  INDAW
THTHEDOORMA SBOCA  AEOEY  KNRIO
TREPLACEITO  EEMTU  YAAOT
NYOURWAYOUT
```

Figure 1. Sample cryptogram.

```
EFTPR  TTCSN  TCINC  EOIMT  OTRNA  BNFIE  NNEOD
EERUE  LTFRO  EEAPT  AINEA  ATOSN  TALIM  ANENE
LHTOR  HCPRD  VSILI  RRRSE  WNAOT  EESAC  EMTOE
LTBTS  PHUHE  MSHAS  OTTRR  SNCTI  NYMTT  EETUI
AOTRE  LEEET  ETOOS  DSOTS  QRWND  EONNB  YEXHL
BOEAT  APSCD  DRITI  TUSER  CSITR  RIRAE  HTENN
BROTE  CLDTL  TIEHS  INEYU  GNHAN  GSGAE  I
```

Figure 2. Cryptogram produced by the Program Listing.

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you, the sender, need accomplish is to delay the inevitable, unauthorized reading long enough to accomplish your purpose.

Cryptology is a challenge worthy of the most agile minds. Solving cryptograms is almost as popular as working crossword puzzles, and now the microcomputer adds yet another dimension to its attraction. It is indeed a challenge to conceal a message to the extent that it lies open but incomprehensible to all but the intended receiver, and to discover the meaning in such a message despite the efforts of the originator to conceal it.

Columnar Transposition

A simple yet effective method to conceal the message's meaning is to write the plaintext with a fixed number of letters per line and then place each succeeding line directly beneath to produce a stack of rows. You create the cryptogram in Fig. 1 by picking letters from the rows vertically downward, beginning

with Row 1.

The key to the cryptogram is a four-part agreement between sender and receiver: use an 11-letter line, closed letter spacing, pickoff from the top down, and left to right progression.

To restore the cryptogram to plain language, the intended receiver rearranges each five-letter code group in turn in vertical columns, and reads the message from left to right.

As you become familiar with this type of cryptogram you will recognize it almost by cursory inspection. Soon you'll be able to read the message directly from the code groups without going to the trouble of writing it down. Does this suggest a Basic routine to solve the cryptogram? While I cannot reply individually to all letters, I will use (with name credit) the best one in a future article in this series. Strive for simplicity, not elegance or fewest bytes.

Rearranging letters from their natural order may take on almost any variety of pattern and form. Use any key

agreed on between correspondents. In the foregoing example, you can begin construction of the ciphertext by starting at the upper right-hand corner of the plaintext stack and progressing in either a clockwise or counterclockwise spiral until you record the last letter. You might begin at a corner and take off letters in a zigzag pattern downward or horizontally. Beginners can see how many different patterns they can devise and then inspect their results to find the most complex and the simplest. You can devise patterns that require your correspondent to spend hours of reconstruction time, by superenciphering each ciphertext you come up with—that is, submitting each resulting ciphertext to another encipherment as though it were the original plaintext message.

“Solving cryptograms is almost as popular as working crossword puzzles, and now the microcomputer adds yet another dimension to its attraction.”

You will soon discover that you might spend 24 hours superenciphering, and yet the plaintext would be recoverable, provided you recorded every step of your key patterns. But would the recovery effort be worth the value of the message? A record of the descrambler key pattern could be far longer than the ciphertext message itself.

Why not let the computer handle the immense routine of descrambling such a message? It could handle thousands of patterns in just a few seconds. Yes, it is possible, but again, is it practical? Chances are, there are better, more secure programs requiring far less concern and attention from the programmer.

If you are a chess player, you are aware of an exercise called a “Knight’s Tour.” The knight moves in a dogleg, that is, two squares horizontally and one square vertically, or vice versa. It is possible to take the knight on a number of different “tours” around the chessboard, landing only one time on every one of the 64 squares. Suppose there were 64 letters comprising a plaintext message that you want to encipher and send to a fellow chess player. If you place each letter in turn on one of the

```

1 ' Model I, Model III and Model 100 delete lines 70, 80, and 90
2 ' Model I, Model III and Model 100 delete all TABS
3 ' Model 100 delete all STRING$S
9 CLEAR 100
10 CLS 'Reconfigure tabs and string lengths for Model III
20 PRINTTAB(10)STRING$(60,"") 'Title routine thru line 90
30 PRINTTAB(10)STRING$(18,"") CRYPTO TRANSPOSER AIDE " STRING$(18,"")
40 PRINTTAB(10)STRING$(20,"") by Karl Andreassen " STRING$(20,"")
50 PRINTTAB(10)STRING$(22,"") Copyright 1983 " STRING$(22,"")
60 PRINTTAB(10)STRING$(60,"") :PRINT
70 PRINT CHR$(02) :PRINT@ (7,10),STRING$(10," ")
80 PRINT@ (0,24), CHR$(128) STRING$(30,150) CHR$(129);
90 PRINT@ (4,24), CHR$(131) STRING$(30,150) CHR$(130);
100 PRINT :PRINT 'Reduce array sizes for ModIII to conserve memory
110 CLEAR 3000 :DIM A$(200),B$(1000) 'Maximum 200 words plaintext
120 PRINTTAB(14)"This program will convert plaintext into ciphertext"
130 PRINTTAB(12)"using columnar transposition with selectable row number."
140 PRINT :PRINT :INPUT "Number of rows in column, 1 to 79";J '63 for ModIII
150 IF J=0 THEN 10ELSE PRINT "Enter plaintext, < * > to end input:" :PRINT
160 Z$=INKEY$:IF Z$="" THEN 160
170 PRINT Z$; 'Keyboard input routine, 160-240
180 IF Z$="" THEN 220'Keyboard entry closure.
190 IF Z$=" " THEN 160'Keep spaces out of text, visual ok.
200 A=A+1 :Y$=Y$+Z$ 'Row number counter; word string var.
210 IF A>J-1 THEN 220ELSE 160
220 X=X+1 :A$(X)=Y$ :Y$="" :A=0 :PRINT Y$
230 IF Z$="" OR X>199 THEN PRINT :PRINT :GOTO 250
240 GOTO 160'Line above for desired or auto input cutoff
250 PRINT "Ciphertext in preparation:" :PRINT
260 FOR C=1 TO J 'Ciphertext preparation routine
270 IF D=1 THEN 300'Switch determines direction
280 IF D=0 THEN 330'of letter takeoff from each row.
290 IF C=J THEN 370ELSE NEXT C
300 FOR B=1 TO X 'Collect row letters, top to bottom
310 GOSUB 360'Load ciphertext letters array, down
320 NEXT B :D=0 :GOTO 290'Toggle
330 FOR B=X TO 1 STEP -1 'Collect letters, bottom to top
340 GOSUB 360'Load ciphertext letters array, up
350 NEXT B :D=1 :GOTO 290'Toggle
360 E=E+1 :B$(E)=MID$(A$(B),C,1) :RETURN
370 FOR G=1 TO E 'Print ciphertext to screen, 5-letter groups
380 IF LEN(B$(G))>0 THEN PRINT B$(G); ELSE H=H-1
390 H=H+1 :IF H=5 THEN PRINT " "; H=0
400 NEXT G :H=0 :PRINT :PRINT
410 INPUT "End of cryptogram. Print hard copy < Y/N >";Q$
420 IF Q$="Y" OR Q$="y" THEN 440
430 IF Q$="N" OR Q$="n" THEN END ELSE PRINT "Reenter instruction" :GOTO 410
440 FOR G=1 TO E 'Hardcopy printout option
450 IF LEN(B$(G))>0 THEN LPRINT B$(G); ELSE H=H-1
460 H=H+1 :IF H=5 THEN LPRINT " "; H=0 :I=I+1
465 IF I>6 THEN LPRINT :I=0
470 NEXT G :LPRINT :END

```

Program Listing. Crypto Transposer.

squares visited in your knight's tour, you would have a cube of systematically patterned letters. Take those letters off five at a time in a prearranged manner, place them in ciphertext message, and you have a fairly secure message for transmission.

Chess can be played by mail, telephone, and radio. There is a classic numbering system for the squares, known to all chess players, whereby games can be played with players halfway around the world from each other. You can key the message to these numbers or renumber the chessboard to conform to the selected knight's tour of your cipher.

A common configuration places five letters of plaintext horizontally and the next five letters directly beneath to form a stack of five columns. Your computer can accommodate any selected number of columns with ease, and the resulting stack may be seen on screen or not, as the programmer desires. The key for encipherment is called a route transposition, because you will take a certain route around and through the stack to lay out your message in ciphertext. You may decide upon a certain route and use that same route in constructing many stacks of varying quantity of columns, thus varying the approach to each message to complicate analysis by an unauthorized person.

The agreed-on key should make provision for messages of different length. You can do this quite easily in a Basic computer program by permitting stack-

"The program can include word spacing as part of the message intelligence, or close up that spacing to solid text, the latter being the most popular form."

ing rows (horizontal) to increase infinitely, or by allowing for a variable number of columns (verticals). The program can include word spacing as part of the message intelligence, or close up that spacing to solid text, the latter being the most popular form.

The Program

The Program Listing runs on the TRS-80 Models II, 12, and 16, and with cosmetic adjustments to a few lines, on a Model I, III, or 100 (see the first few lines of the Listing). Taking its cue from the foregoing transposition cipher form, it simulates setting up a column with a selectable number of rows from one to 79, and converts up to 200 words of plaintext to ciphertext.

The column generated doesn't appear on the screen as written, but the plaintext appears letter by letter as entered from the keyboard. When your

message is complete, touch the asterisk key and the program produces the ciphertext in five-letter code groups. If your message exceeds 200 words, the program proceeds as though you had touched the asterisk, abruptly cutting off further keyboard entry. When the ciphertext is complete on screen, a prompt appears with an option to hardprint the ciphertext (see Fig. 2).

If you prefer to see the column as compiled in preparation for extracting the ciphertext, edit lines 170 and 220 to read:

```
170 'PRINT Z$; 'Keyboard input routine,
160-240
220 PRINT Y$:X=X+1:AS(X)=Y$:Y$=""
:A=0
```

The apostrophe in line 170 temporarily disables the command from printing text as entered from the keyboard, and you can remove it later to restore the original function with a minimum of editing. The program now collects a full row of entry letters before screen print occurs.

The Run command produces the program title and a prompt asking for the desired number of columns in the stack the message text forms. The prompt also advises you that the asterisk will signal the end of keyboard input. You may select any number of columns between one and 79, except that the Model III is limited to 63. If you answer the prompt with 1, the message is written in one line, but in reverse (may be read with a mirror). The number of columns you select influences the stack depth, since the message has a finite length. If both sender and receiver are aware of this number, deciphering the message is relatively easy. A program to assist in analyzing ciphers developed by this and similar transposition methods will be the subject of a future article in this series.

Also in preparation are programs to create and help solve ciphers that employ numerals. Figures 3, 4, and 5 are enciphered challenges to your growing skill with computer-assisted cryptanalysis. *80 Micro* will award a subscription or extension to the first three readers to send in correctly interpreted solutions.

An excellent book to introduce the finer points of reading the unreadable is *Cryptanalysis* by Helen Fouche Gaines (Dover Publications), available in most large public libraries. ■

Karl Andreassen can be reached at 24750 Chianti Road, Cloverdale, CA 95425.

YFPXS	GXJSJ	IXZQP	IXDPG	JQXXU	YFPXJ
OSAXG	XZJDT	SBXFJ	DIXXY	HPVGQ	DZYUS
CHIVT	XKVGJ	ZWXMO			

Figure 3. A cryptogram to test your skills at cryptanalysis.

QDIXB	ZFFBS	YPTXG	JQBXX	JISNZ	FFYIN
HJSTZ	YDVGX	QQXXU	HSFVJ	VYZFZ	QNFTPT
AXCSI	XQPGG	SOGJS	ZKSVB	YSGQX	RPXGY
XQYSP	HVGXK	VJZAF	XZDXR		

Figure 4. A second cryptogram challenge.

ODNAL	BFIDC	RSNSL	EGIER	WCDIN	EYGCY	PIVSD
GLEIH	IPAEI	LTJET	ONAEI	WMLHC	HECIO	TMWCL
OEOAT	RNRRI	OAYDT	ETROG	YFDIR	HSPCU	LRTTY
SCSCI	SOCAL	OOOYA	CPGPF	TLOMT	HMMLI	TRRTK
TOAOH	SYPU	ANOSA	EDMGH	EROUM	CCSIR	TCERH
OCRAK	EMTES	AADAA	NTOML	TAOFY		

Figure 5. A third cryptogram challenge.

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REM Remover

by Charles R. Perelman

Although remark statements are helpful, they can also waste memory space; here's a way to remove them from your Model II programs.

Program Listing. Remover.

```

0 *****
10 'REM REMOVER - FILE NAME 'REMOVER'
20 'BY CHARLES R. PERELMAN, A PROFESSIONAL CORPORATION
30 '9777 WILSHIRE BLVD., BEVERLY HILLS, CA. 90212 -- 1982
40 'FOR TRS-80 MODEL II
500 *****
510 'INITIALIZE
520 CLEAR 1000
1000 *****
1010 'INSTRUCTIONS
1020 CLS:PRINT " YOU MUST OPEN 2 FILES WHEN ENTERING BASIC TO USE THIS PROGRAM."
:PRINT " IF YOU DID NOT DO SO, PRESS <BREAK>, TYPE 'SYSTEM' TO GO BACK":PRINT "TO
:TRSDOS. THEN TYPE 'BASIC REMOVER -F':2 AND <ENTER>":GOSUB 6020
1030 CLS:PRINT " REM REMOVER WILL TAKE ALL REM LINES OUT OF YOUR PROGRAM EVEN:PR
INT "IF YOU ABBREVIATE WITH AN APOSTROPHE. THE FILE MUST HAVE ":PRINT "BEEN SAVED
IN ASCII TO BE PROCESSED PROPERLY.":GOSUB 6020
2000 *****
2010 'INPUT DATA
2020 ON ERROR GOTO 5020 'TRAP FILES NOT OPENED. WRONG NAME, NOT ASCII
2030 CLS:LINE INPUT "PLEASE TYPE NAME OF ASCII FILE TO HAVE REM STATEMENTS REMOVE
D: ";$
2040 N=INSTR($,"/"):IF N=0 THEN F1$=F$+"RR" ELSE F1$=LEFT$(F$,N)+"RR" 'CHECK
FOR EXTENSION, FORM OUTPUT FILE NAME
2100 *****
2110 'OPEN SEQUENTIAL FILES
2120 OPEN "I",1,F$ 'USE BUFFER 1 FOR ASCII FILE INPUT
2130 OPEN "O",2,F1$ 'BUFFER 2 FOR OUTPUT WITH /RR EXTENSION
2140 PRINT:PRINT CHR$(31)*** PLEASE WAIT, COMPUTER IS WORKING *** 'YES, SOME
THING'S HAPPENING
2150 IF EOF(1) THEN 2240 'LOOK FOR LAST INPUT LINE
2160 LINE INPUT#1,L$
2170 IF INSTR(L$,"")>0 OR INSTR(L$,"REM")>0 THEN GOSUB 3120 'IF REM PROCESS
2180 IF F=1 THEN F=0:GOTO 2150 'ENTIRE LINE REM, DO NOT OUTPUT
2200 *****
2210 'OUTPUT PROCESSED LINES
2220 PRINT #2,L$
2230 GOTO 2150
2240 CLOSE 1,2
2250 CLS:PRINT CHR$(30) " PROCESSING COMPLETED. FILE WITHOUT REMARKS HAS BEEN
SAVED":PRINT "WITH NAME OF "F1$. ORIGINAL FILE REMAINS WITH NAME OF "F$":GOT
O 4020
3000 *****
3010 'PROCESS REM LINES
3120 S=INSTR(L$,""):LNS=LEFT$(L$,S):LRS=RIGHT$(L$,LEN(L$)-S) 'LNS=LINE NO.
3130 IF INSTR(LRS,"")=1 OR INSTR(LRS,"REM")=1 THEN F=1:RETURN 'ENTIRE LINE REM
3140 IF INSTR(LRS,CHR$(34))>0 THEN GOSUB 3220:RETURN 'GO TO QUOTE ROUTINE
3150 N=INSTR(LRS,""):IF N>0 THEN LRS=LEFT$(LRS,N-1):L$=LNS+LRS:RETURN 'CHOP REM
3160 N=INSTR(LRS,"REM"):FOR X=N TO 1 STEP -1:IF MID$(LRS,X,1)="" THEN L$=LNS+L
EFT$(LRS,X-1):RETURN ELSE NEXT X 'REMOVE LAST COLON AND REM
3200 *****
3210 'QUOTE ROUTINE
3220 LQS=RIGHT$(LRS,LEN(LRS)-INSTR(LRS,CHR$(34))) 'CHOP FIRST QUOTE
3230 Q=INSTR(LQS,CHR$(34))

```

Listing continued

When I write new programs, I make liberal use of remark statements. They're helpful in identifying distinct program modules and in debugging and modifying a program. They also clarify routine logic when I haven't seen a program for a while. But program remarks take up memory, a limited resource with some programs. I wrote a Model II program that removes program remarks (see Program Listing).

Use REMOVER/BAS after you've debugged your programs. Ironically, I documented Remover with a heavy dose of remark statements so you can easily trace program flow. The program variables appear in Table 1.

This program recognizes both the REM command and the apostrophe as indicators of a remark statement. Remover ignores print statements that contain a remark. The program deletes only lines that are entirely remarks or that have comments at the end of a line.

Program Operation

Remover treats your program as a sequential file. As with all sequential files in the body of a program, the disk directory indicates that the new file has a record length of 1 byte.

The file is in ASCII format rather than in compressed format. You must

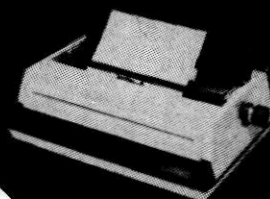
The Key Box

Model II
Model I and III (with changes)
Model 100 (with changes)
32K RAM
Disk Basic

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put your file in ASCII format to process it with Remover. Load your program in Basic and save it by adding A to the file name.

The reduced file has the same initial file name and the extension /RR, signifying that you've removed the program's remarks. You can leave the file in its ASCII format or save space by changing it back to compressed format. To do so, load the new file and save it without adding the A to the file name. ■

Charles R. Perelman is an attorney and CPA specializing in estate and tax planning. He can be reached at 1800 Century Park East, Suite 1105, Los Angeles, CA 90067.

Listing continued

```

3240 IF Q=0 OR Q=LEN(LQ$) THEN RETURN 'NO SECOND QUOTE OR END OF LINE
3250 LQ$=RIGHT$(LQ$,LEN(LQ$)-Q) 'MOVE TO SECOND QUOTE
3260 IF INSTR(LQ$,"")=0 AND INSTR(LQ$,"REM")=0 THEN RETURN 'NO REMS AFTER Q
      UOTES
3270 Q=INSTR(LQ$,CHR$(34)):IF Q>0 THEN LQ$=RIGHT$(LQ$,LEN(LQ$)-Q):GOTO 3230
      'LOOK FOR ADDITIONAL QUOTES
3280 IF INSTR(LQ$,"")>0 THEN L$=LN$+LEFT$(LRS,LEN(LRS)-LEN(LQ$)+INSTR(LQ$,"")-
      1):RETURN 'NO MORE QUOTES, CHOP REM
3290 FOR X=LEN(LQ$) TO 1 STEP -1:IF MID$(LQ$,X,1)=":" THEN L$=LN$+LEFT$(LRS,(LEN
      (LRS)-LEN(LQ$)+X-1)):RETURN ELSE NEXT 'REMOVE LAST COLON WITH REM
4000 *****
4010 'END OF PROGRAM
4020 PRINT@565,"DO YOU WANT TO PROCESS ANOTHER PROGRAM? (Y/N) ";
4030 Z$=INKEY$:IF Z$="" THEN 4030
4040 IF INSTR("YN",Z$)=0 THEN PRINT CHR$(8):GOTO 4020 'TRAP BAD ENTRY
4050 IF Z$="Y" THEN 2020 ELSE PRINT:PRINT:PRINTTAB(20)**** END OF PROGRAM ****:E
      ND
5000 *****
5010 'ERROR ROUTINES
5020 IF ERR=53 THEN PRINT:PRINT"FILE NOT FOUND":GOSUB 6020:RESUME 2030
5030 IF ERR=54 THEN PRINT:PRINT"FILE IS NOT ASCII FORMAT. CANNOT BE PROCESSED":
      GOSUB 6020:CLOSE:RESUME 2030
5040 IF ERR=52 THEN PRINT:PRINT"YOU DID NOT OPEN FILES. PROGRAM WILL END AND RE
      TURN TO TRSDOS";FOR X=1 TO 1500:NEXT:SYSTEM
6000 *****
6010 'PAUSE
6020 PRINT:PRINT"PRESS ENTER TO CONTINUE";
6030 Z$=INKEY$:IF Z$="" THEN 6030 ELSE RETURN

```

F	If flag F=1 whole line is REM and is not output
F\$	Name of original ASCII file
FI\$	New file name with REMs removed and "/RR" added
L\$	One line of ASCII input or output file
LN\$	Line number
LQ\$	Partial line which included quotes
LRS	Balance of line excluding line number
N	Index for INSTR in file name
Q	Index for INSTR to find quotes
S	Index for first space to isolate line number
X	Counter variable
Z\$	INKEY\$ character input

Table 1. Variables list.

Lines 1020 and 5040 change 'SYSTEM' to 'CMD"S'

Line 2140 change CHR\$(31) to CHR\$(23)

Line 2250 change CHR\$(30) to CHR\$(28)

Line 4020 change print@ location from 565 to 455

Table 2. Conversions for Model I/III.

Be sure Model 100 is set at MAXFILES=2

Delete lines 1020, 2040, 2120, 2130, 5030

Reformat print lines to fit Model 100 screen.

Change :

line 2140 eliminate CHR\$(31)

line 2250 eliminate CHR\$(30)

line 5020 change 53 to 52

line 5040 change 52 to 51

Add:

2035 FI\$="RAM:"+F\$

2040 FI\$="RR"+LEFT\$(F\$,3)+"DO"

2045 FO\$="RAM:"+F1\$

2120 OPEN FI\$ FOR INPUT AS 1

2130 OPEN FO\$ FOR OUTPUT AS 2

Table 3. Conversions for Model 100.

Why aren't you using 'Trashman'?

1. I don't have a TRS-80
2. I don't use any BASIC programs
3. I never heard of "TRASHMAN"
4. I don't believe it will work.
5. I don't mind waiting for the computer.
6. I haven't gotten around to ordering it.
7. (your excuse here)

Have we gotten your interest?
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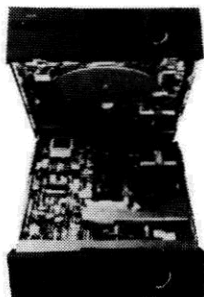
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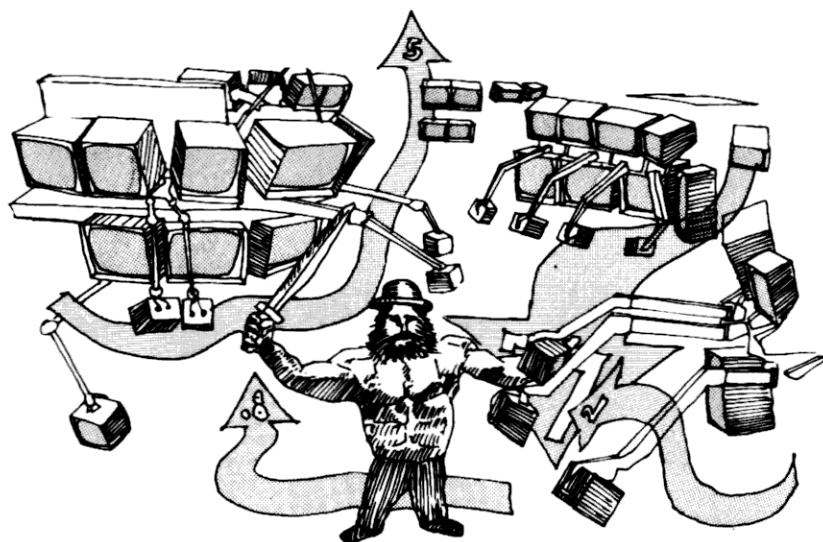
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Straddle the Market

by John Bell



This quick introduction to stock options should give you some money-making ideas.

The stock market is no place for amateurs, but with my Straddle Program and your Model I or III, Wall Street may have to make room for a few more professionals.

The program helps you select a straddle with good potential. You can profit whether the market goes up or down, as long as it does not go too far in either direction (see the Program Listing).

The Market

A stock option is a contract to buy or sell a stock (in 100-share lots) at a fixed price any time before a fixed date. The price is known as the *strike price* and the date is the *expiration date*.

A *call* is a contract to sell and a *put* is a contract to buy. A *straddle* is a call and a put covering the same stock. Straddles usually have the same expiration date but may have different strike prices. A straddle with two strike prices is a *split straddle*. Options on the US markets expire the third Friday of each month, usually after a nine-month life.

A naked option is one written (sold) by a person not owning the stock covered by the option. He has to deposit a cash or security margin with the broker handling the transaction. This protects the buyer.

An option is terminated by: failure

```

ENTER STOCK SYMBOL & NO SHARES? GM
?? 800
ENTER MARKET PRICE OF PUT & CALL? 1.625
?? .3125
EXPIRATION MO. ? CURRENT MO. & DAY? 6
?? 4
?? 17
ENTER INTEREST RATE %? 15
IF VOLATILITY IS KNOWN ENTER TWO 0s OTHERWISE ENTER THE HI AND
LO STOCK PRICE? 59
?? 39
STOCK PRICE AND STRIKE PRICE AND DELTA STRIKE PRICE? 52
?? 60
?? 10.
  
```

Table 1. General Motors split straddle, April 17, 1981.

GM			
STOCK PRICE	STRIKE PRICE	DELTA STRIKE	DAYS
52	50	10	62.05
VOLATILITY	CALL MKT	PUT MKT	STRAD MKT
.27	.3125	1.625	1.9375
CALL THEO	PUT THEO	STRAD THEO	DIFF
.46	.98	1.45	.48
HI BE	LO BE	MARGIN	NO SHARES
61.68	48.31	9444	800

Table 2. A good straddle.

The Key Box

Model I and III
16K RAM
Cassette Basic

of the owner to exercise before expiration, exercise of the option by the owner, or repurchase of the option by the seller. About 85 percent of all options are terminated by repurchase.

Professors Black and Scholes of the University of Chicago and MIT developed a formula to calculate an option's theoretical value. Their statistical studies indicate a profit is more probable if the options are sold when the theoretical price is below market price or bought when the theoretical price is above the market.

The computation requires stock price, strike price, days to expire, interest rate, and volatility. The stock and strike prices are readily available. Interest rates are whatever you can get for your money. The program calculates the number of days to expire and the volatility.

To save you the trouble of actually counting the number of days, the program will estimate the number of days if given the expiration month and present date. The figure may be slightly in error, but not enough to materially affect the calculated price.

To calculate volatility enter the high and low stock price from the previous year (available in *The Wall Street Journal*). Or enter zeros for the high and low and then enter a volatility from an option consultant. Commissions and margins are included in the calculation.

You can select a straight or split straddle. A straight straddle has the same strike price for the put and the call. A split straddle usually has a put with a lower strike price than the call. The difference is called *delta strike*. If you enter a split straddle in the program enter the high strike price first. For a straight straddle the delta strike is zero.

Table 1 shows data entered for a General Motors split straddle from information available on April 17, 1981. This straddle has a June 60 call and a June 50 put. Table 2 shows the completed calculation. This is a good straddle to write. The market price is above the theoretical price and more than 13 points are between the high and low break-even prices.

June 19th—the call and the put are listed at 1/16. Neither will be exercised because the price is 55½. This means you do not have to buy them back. The profit is \$1.78 on each of the 800 shares, or a little more than \$1,400. This works out to about 85 percent profit on the \$9,444 margin on an annual basis.

Punch it in and good luck! ■

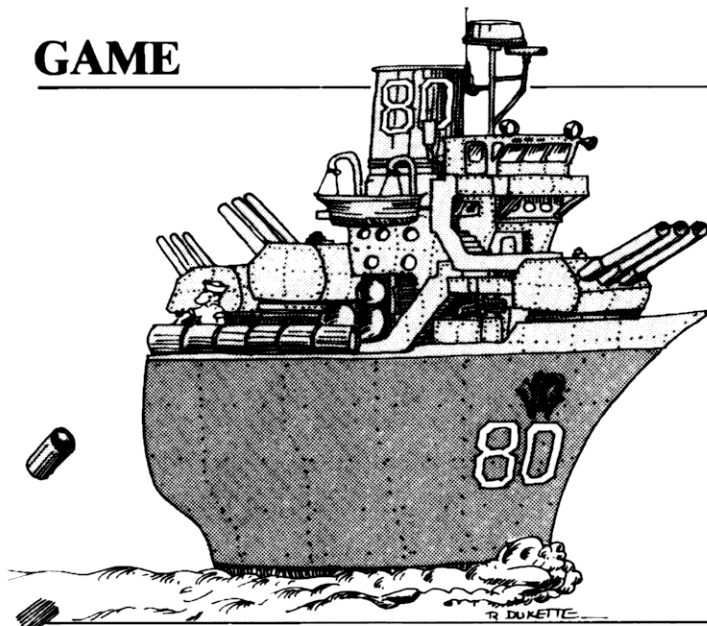
John Bell can be reached at 101 SW 58th Terrace, Cape Coral, FL 33904.

```

8 CLS
9 INPUT "ENTER STOCK SYMBOL & NO SHARES" ; A1$,S
10 INPUT "ENTER MARKET PRICE OF PUT & CALL" ; PM,CM
11 INPUT "EXPIRATION MO. & CURRENT MO. & DAY" ; T,T1,T2
15 T3 = T*.0833+.051: T9=T1*.0833: T3 =T3-T9
16 A3=T3-(T2/365)
17 IF A3<0 THEN 19
18 GOTO 20
19 A3=1+A3
20 INPUT "ENTER INTEREST RATE %" ; A5
21 A5= A5/100
30 INPUT "IF VOLATILITY IS KNOWN ENTER TWO 0s OTHERWISE ENTER
THE HI AND LO STOCK PRICE" ; V1,V2
31 IF V1 = 0 THEN 38
32 V3=V1-V2: V4= (V1+V2)/2 : A4= (V3/V4) [ (.83) *.57
33 GOTO 40
38 INPUT "ENTER ACTUAL VOLATILITY" ; A4
40 INPUT "STOCK PRICE AND STRIKE PRICE AND DELTA STRIKE PRICE";
A1,A2,DE
50 A=A4*(A3[ (.5) ]): A7=A5*A3:B=A1/A2:C=1/A*(A7+LOG (B)): A6= C+(A
/2): X=A6
52 IF A6>0 THEN GOTO 56
54 A6=A6*(-1)
56 A9=1/((A6*.3327)+1): D=A9*(-.12): I=A9[(2)*.9371
58 E=A9*(D+I+.4362): F=A6[(2): G=F/2*-1 : H=2.7183[(G)/2.5066
59 I = E*H
60 IF X<0 THEN GOTO 64
62 I=((-1)*I+1)
64 K=I*A1: Z6=C- (A/2)
66 IF Z6>0 THEN GOTO 70
68 Z6=Z6*(-1)
70 Z9=1/((Z6*.3327)+1)
72 D2=Z9*(-.12): I2= Z9[(2)*.9371:E2=Z9*(D2+I2+.4362)
74 F2=Z6[(2): G2=F2/2*(-1): H2=2.7183[(G2)/2.5066:I2=E2*H2
76 IF X<0 THEN GOTO 82
77 IF A1<A2 THEN 82
78 IF I2<0 THEN GOTO 82
80 I2= I2*(-1)+1
82 L2=A2*I2*(2.7183[(-A7)])
84 O= K-L2: Y=A3*A5*(-1): P=2.7183[(Y)*A2-A1+O: IF Q=10 GOTO 89
86 Q=10: O1=O: A2=A2-DE: GOTO 50
89 O=O1
90 PO=PM
91 GOSUB 200
92 RP=PM - CO : PO=CM
93 GOSUB 200
94 RC=CM - CO: RS=RP+RC : PO=RS
95 GOSUB 200
96 BS=RS - CO: HB=A2+BS+DE: LB=A2-BS
97 IF DE=0 THEN 103
98 IF A1< A2 THEN 102
99 IF A1 > A2+DE THEN 101
100 MC=ABS ((A1-A2)-DE/2) : MC=(DE/2-MC)*-1: GOTO 105
101 MC = A1-(A2 +DE): GOTO 105
102 MC = ABS(A2-A1): GOTO 105
103 MC = ABS(A1-A2): GOTO 105
105 MA=A1*.3 -(RC+RP) + MC : MR= MA*S
108 SM=CM+PM: ST=O+P: DF=SM-ST
110 Y=A3: GOSUB 130: A3=Y1: Y=A4: GOSUB 130: A4=Y1: Y=O: GOSUB 130: O=Y1
: Y=P: GOSUB 130: P=Y1
112 Y=ST: GOSUB 130: ST=Y1: Y=DF: GOSUB 130: DF=Y1: Y=HB: GOSUB 130: HB=
Y1: Y=LB: GOSUB 130: LB=Y1
114 X1$="STOCK PRICE": X2$="STRIKE PRICE": X3$="DELTA STRIKE": X4$
="DAYS"
116 X5$="VOLATILITY": X6$="CALL MKT": X7$="PUT NKT": X8$="STRAD MK
T"
118 U1$="CALL THEO": U2$="PUT THEO": U3$="STRAD THEO": U4$="DIFF"
120 U5$="HI BE": U6$="LO BE": U7$="MARGIN": U8$="NO SHARES"
122 GOTO 148
130 Y1=Y*100: Y2=INT (Y1): Y1=Y2*.01
132 RETURN
148 CLS
149 PRINT A1$
150 PRINT X1$,X2$,X3$,X4$
152 PRINT A1,A2,DE,A3*365
154 PRINT
156 PRINT X5$,X6$,X7$,X8$
158 PRINT A4,CM,PM,SM
160 PRINT
162 PRINT U1$,U2$,U3$,U4$
164 PRINT O,P,ST,DF
165 PRINT
166 PRINT U5$,U6$,U7$,U8$
168 PRINT HB,LB,MR,S
170 END
200 IF PO<1 THEN 204
201 S1=(LOG (S)*(.0017)*(-1)+(.0235))*PO
202 S2=1/S[ (.284) *.611: CO=S1+S2: GOTO 206
204 CO=PO*.1
206 RETURN

```

Program Listing. Straddle.



Depth Charge

by L.B. Cebik

This simulation of a sea battle offers the beginning programmer a chance to develop his talents at moving objects on the screen.

Depth Charge is a simulation of a sea battle with you in command of the destroyer; the object is to destroy as many undersea installations as possible by using depth charges. Since depth charges aren't as accurate as missiles, it takes luck as well as skill.

The game uses under 2K of memory, fewer if you omit the remarks.

If you're a beginning programmer in Basic, this program gives you a platform on which to experiment. You can revise the program and test your skill in handling the elements of Basic.

When running through the program,

you'll encounter both point and character graphics, and ways to make them track each other. Subroutines are used extensively to keep the graphics moving. You set up the targets with a random number routine. At the end of the program are optional explosion effects.

Print and overprint techniques pack the maximum material onto the display without restricting the action. You can vary or restructure any of these elements to improve the game, to practice programming, or just to see what will happen.

Program Listing 1 shows the pro-

gram without explosion effects.

Line 20 initializes the values. Figure 1 lists the variables and their meanings. The most important variables are C and S, for scoring, and Z.

Put the targets on line 39, and let the random number feature place them in positions 4-110. Save the first four to prevent later explosions from falling off the screen. I don't use the 17 positions to the right because the combination of the ship's size and the trajectory of the charges keeps them out of striking range. Some of the numbers in the routine may be repeats; hence, I set out 18 targets to be sure I have at least a dozen to hit.

The ship is created from the characters available from 128-191. This ship is a one-line, seven-character object. (See Fig. 2.) Note that the first character on the left is a blank. As the ship moves from left to right across the screen, this blank leaves a clean path behind. If you select the right characters, you can create a sea surface behind your vessel.

Lines 60-140 move the ship; it cycles from positions 128-186 (all on character line 3). Stop before you reach the last position (191), or a piece of the ship remains on the right edge of the screen. Remember, you count its position from its left-most character. You now have a permanent ship on the right side of the screen after the first pass. Line 80 erases it by overprinting spaces when the ship returns to the left.

While moving the ship from space to

Variable	Meaning	Range
Main Game		
A	Position of ship	128 to 186
C	Number of charges fired	0 to indefinite
S	Number of strikes	0 to 10
T	Number of targets	up to 18
TH	Horizontal position of target	4 to 110
X	Horizontal position of charge	0 to 119
Y	Vertical position of charge	8 to 40
Z	Quasi-random factor	2 or 3
Q	Position of "Boom"	920 (898-946)
AS	Ship characters	
BS	INKEY\$ to fire (F) or slow (S)	
CS	INKEY\$ to replay (N) or end (E)	
QS	"Boom"	
RS	Spaces to clear "Boom"	

Additions for explosion effects:

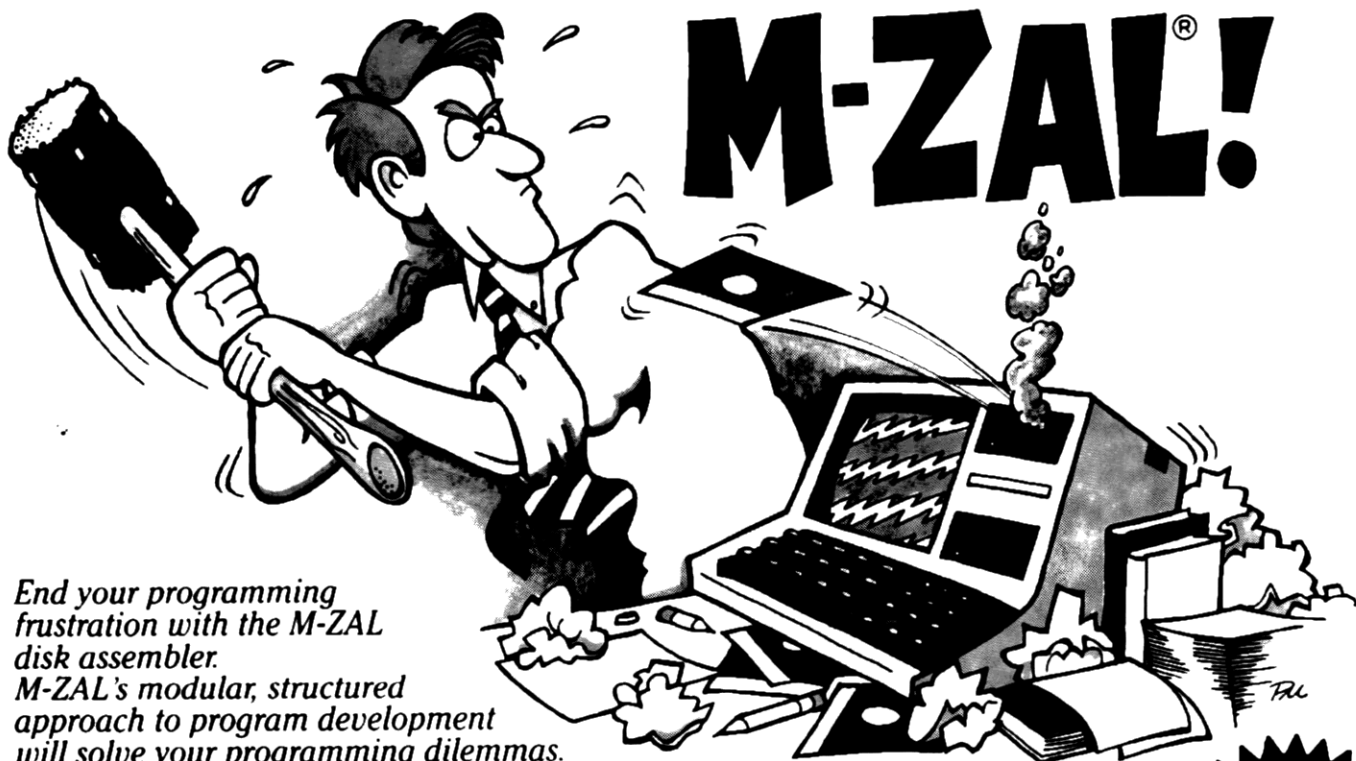
XA, XB	Horizontal position-fragments	X to X + -3
YZ	Vertical position-fragments	38 to 35

Figure 1. Variables list.

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```

1  '**DEPTH CHARGE**: A GAME OF SKILL & LUCK, BY L. B. CEBIK.
   CREATED 7-1-81 ON TRS-80 III USING BASIC ONLY.
2  'REQUIRES LESS THAN 2K OF MEMORY TO STORE AND RUN.  USES
   SUBROUTINES TO KEEP THE PACE OF THE SHIP AND CHARGES VERY
   FAST.  TO SLOW SHIP, ADD LINES BETWEEN 60 & 140.
10 CLS:PRINT @ 4,"**DEPTH CHARGE**";PRINT @ 31,"PRESS <F> TO FI
RE; <S> TO SLOW."
20 C=0:S=0:A=128:Q=920:X=0:Y=0:Z=2  'INITIALIZE VALUES
30 FOR T=1 TO 18:TH=RND(110):IF TH>3 THEN SET(TH,39)
40 NEXT T
50 A$=CHR$(128)+CHR$(139)+CHR$(188)+CHR$(191)+CHR$(188)+CHR$(159
)+CHR$(135)  'CREATE SHIP
60 FOR A=128 TO 186:IF A=186 THEN A=128
70 PRINT @ A,A$
80 IF A=129 THEN PRINT @ 186,"      "  '6 SPACES TO BLANK SHIP
110 B$=INKEY$:IF B$="F" OR B$="S" THEN GOSUB 200
120 PRINT @ 64,"STRIKES:";S;:PRINT "CHARGES:";C
130 IF S=10 THEN 400
140 NEXT A
200 'SUBROUTINES FOR SLOW AND FIRE.
210 IF B$="S" THEN A=A-2:GOTO 350
220 IF B$="F" THEN R$=STRING$(12," "):PRINT @ Q,R$;C=C+1  '12
SPACES TO CLEAR BOOM
230 Z=Z+1:IF Z=4 THEN Z=2
240 X=((A-128)*2)+Z
250 FOR Y=8 TO 12:SET(X,Y):IF Y>8 THEN RESET(X+1,Y-1):RESET(X,Y-
1)
260 IF X>1 THEN X=X-1 ELSE X=X
270 NEXT Y  'LOFT OF CHARGES
280 FOR Y=13 TO 20:SET(X,Y):RESET(X,Y-1):RESET(X+1,Y-1)
290 NEXT Y
300 FOR Y=21 TO 40:SET(X,Y):RESET(X,Y-1)
310 IF POINT(X,Y+1) THEN S=S+1:PRINT @ Q,"* * BOOM * *";
320 NEXT Y:RESET(X,40):GOTO 350
350 RETURN
400 'CLOSEOUT ROUTINE
410 PRINT @ 104,"SCORE:";(S/C)*1000000
420 PRINT @ 970,"TO PLAY AGAIN, PRESS <N>; TO END, PRESS <E>.";
430 C$=INKEY$:IF C$="N" THEN 10
440 IF C$="E" THEN 450 ELSE 430
450 CLS:PRINT @ 527,"THANKS, AND HOPE TO SEE YOU SOON!"
490 END

```

Program Listing 1. The Basic Game

Program Listing 2. Depth Charge with Sound

```

1  '**DEPTH CHARGE**: A GAME OF SKILL & LUCK, BY L. B. CEBIK.
   CREATED 7-1-81 ON TRS-80 III USING BASIC ONLY.
2  'REQUIRES LESS THAN 2K OF MEMORY TO STORE AND RUN.  USES
   SUBROUTINES TO KEEP THE PACE OF THE SHIP AND CHARGES VERY
   FAST.  TO SLOW SHIP, ADD LINES BETWEEN 60 & 140.
10 CLS:PRINT @ 4,"**DEPTH CHARGE**";PRINT @ 31,"PRESS <F> TO FI
RE; <S> TO SLOW."
20 C=0:S=0:A=128:Q=920:X=0:Y=0:Z=2  'INITIALIZE VALUES
30 FOR T=1 TO 18:TH=RND(110):IF TH>3 THEN SET(TH,39)
40 NEXT T
50 A$=CHR$(128)+CHR$(139)+CHR$(188)+CHR$(191)+CHR$(188)+CHR$(159
)+CHR$(135)  'CREATE SHIP
60 FOR A=128 TO 186:IF A=186 THEN A=128
70 PRINT @ A,A$
80 IF A=129 THEN PRINT @ 186,"      "  '6 SPACES TO BLANK SHIP
110 B$=INKEY$:IF B$="F" OR B$="S" THEN GOSUB 200
120 PRINT @ 64,"STRIKES:";S;:PRINT "CHARGES:";C
130 IF S=10 THEN 400
140 NEXT A
200 'SUBROUTINES FOR SLOW AND FIRE.
210 IF B$="S" THEN A=A-2:GOTO 350
220 IF B$="F" THEN R$=STRING$(12," "):PRINT @ Q,R$;C=C+1  '12
SPACES TO CLEAR BOOM
230 Z=Z+1:IF Z=4 THEN Z=2
240 X=((A-128)*2)+Z
250 FOR Y=8 TO 12:SET(X,Y):IF Y>8 THEN RESET(X+1,Y-1):RESET(X,Y-
1)
260 IF X>1 THEN X=X-1 ELSE X=X
270 NEXT Y  'LOFT OF CHARGES
280 FOR Y=13 TO 20:SET(X,Y):RESET(X,Y-1):RESET(X+1,Y-1)
290 NEXT Y
300 FOR Y=21 TO 40:SET(X,Y):RESET(X,Y-1)
310 IF POINT(X,Y+1) THEN GOSUB 500
320 NEXT Y:RESET(X,40):GOTO 350
350 RETURN
400 'CLOSEOUT ROUTINE
410 PRINT @ 104,"SCORE:";(S/C)*1000000

```

Listing 2 continued

space, insert the INKEY\$ function for the subroutines to slow the ship and to fire the charges. Since I did not include the entire routines here, the ship moves swiftly; to slow it, insert more program lines, by dividing up instructions now appearing on one line.

Before the end of the game, you have to learn how to score, and that happens in the subroutines.

The Subroutines

Although there appear to be only two subroutines, at lines 200 and 400, respectively, there are actually three. The first is short, but important. Line 210 moves the ship back two spaces when you press the S key. This allows another shot at almost, but not quite, the same position. Each time, line 350 returns you to the main program.

Line 220 of the program and the F key fire the depth charges. When you fire the charge, two things happen. First, the charge count goes up by one. Then 12 spaces print at position 920 to erase the boom effect. If nothing is hit the spaces don't show. After a hit, the next shot erases the boom created in line 310. Note that on this and other print lines of the program, a semi-colon sometimes prevents the cursor from moving to the next line and erasing part of the game; be sure you include these items in your version of the program.

The charges use the point graphics. Since the point graphics and the character graphics use different counting systems, you must find a way to make them track each other so the charges emerge from the ship rather than empty space. The formula is in line 240; it is only one of several ways to have the point position (X) track the character position (A). Without Z the formula returns only even-numbered answers. Since many of the targets are at odd-number positions, you may never finish a game without an adjustment.

Z's job is to alternate between the value of 2 and 3 with every new shot. Use these numbers, rather than zero and 1 so the charge emerges from the ship instead of the blank space behind it. Shots alternate between odd and even places, but the values are not successive. Hence, you get a quasi-random effect in the shot pattern that causes the player to bracket a target with successive shots.

To create a depth charge with loft, you divide the task into three parts. The first part, lines 250-270, creates the loft between vertical positions 8 and 12. Line 260 keeps the backward motion of the charge from carrying the charge off-


```

420 PRINT @ 970, "TO PLAY AGAIN, PRESS <N>; TO END, PRESS <E>.";
430 CS=INKEY$:IF CS="N" THEN 10
440 IF CS="E" THEN 450 ELSE 430
450 CLS:PRINT @ 527, "THANKS, AND HOPE TO SEE YOU SOON!"
490 END
500 'SUBROUTINE FOR STRIKES
510 S=S+1:XA=X:XB=X
520 Q$=" * BOOM * ":Q=INT((X-12)/2)+896:IF Q<896 THEN Q=896
530 PRINT @ Q,Q$
540 FOR YZ=38 TO 35 STEP -1:IF YZ>35 THEN SET(XA,YZ):SET(XB,YZ)
550 IF YZ<38 THEN RESET(XA-1,YZ+1):RESET(XB+1,YZ+1)
560 XA=XA+1:XB=XB-1
570 NEXT YZ
580 RETURN

```

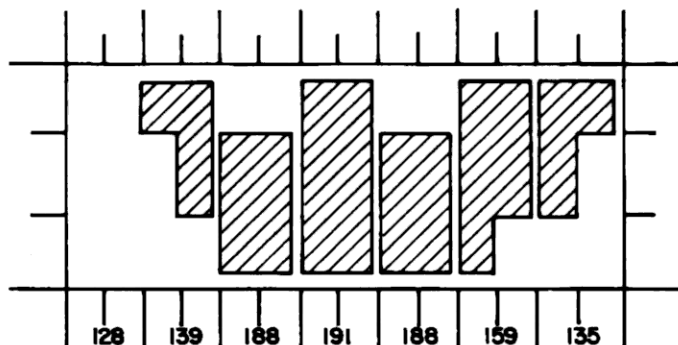


Figure 2. Construction of the ship.

screen, which would cause the computer to interrupt the program. The extra Reset instruction is needed to erase the traces of this adjustment, which occurs in horizontal positions 1-3.

Part 2 of the process is the straight drop; it has an extra Reset function to erase the remnant point created by the last vertical turn. Since this Reset might erase an extra target when you reach vertical position 39, eliminate it at vertical position 21 by entering the third part of the drop. If you hit a target, the strike count goes up by one. Add effects at position 920. You drive the charge through the target to vertical position 40, because you're resetting one point behind and the target at vertical position 39 does not go out until you hit vertical position 40. Before leaving subroutine, erase the point at vertical position 40.

Add some explosion effects with a revision to line 310, and about eight new lines of programming. I omitted them so the game will fit in 1K of memory once the remarks are deleted.

Closing Out

When you get 10 strikes (or however many you wish within limits of the screen), the game ends. The maximum score is a million, but don't expect scores over a few hundred thousand until you master the slow-down movement.

Instructions are provided for either playing again or ending the program. Another INKEY\$ step provides the op-

Line 510 records your strikes and establishes two new variables, XA and tions; to play again, return to line 10 for a new batch of random targets.

To run the game with sound, see Program Listing 2. Revise line 310 to go in to a new subroutine.

XB, which begin with values equal to X. Before you use these variables, lines 520 and 530 reproduce the boom that used to be in line 310. The formula qualification, and the target spaces protected at either end of the line, prevent the boom from exceeding its character line at the screen edges. Lines 540-570 create angular progressions of dots (the explosion) moving up and away from the target. The effect is small, but definite. Your score goes down after adding the effects, since with each strike they distract you from the ship.

All in all, the program is pretty versatile for being so simple. There is room in this program to change many things; for example: the ship graphics, the method of selecting targets, the organization of the messages and other display elements, the trajectory of the charges, the method of scoring, and the way the ship and charges track.

There are other Basic instructions not used in this game; you might think of a good way to use them for additional effects. ■

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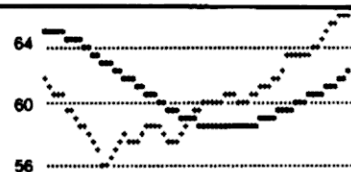
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Extend Radio Shack's Editor/Assembler

by Robert J. Fleck

Here are some new features for the Radio Shack Editor/Assembler. Extend lets you check your object code while you use the editor/assembler.

Program Listing. Extend.

```

00100 ;EXTEND      R. J. FLECK
00105 ;            VER 1.1      APRIL 10, 1983
00110 ;            BEGINS      5D00H      23808D
00120 ;            ENDS       615EH      24926D
00130 ;            ENTRY      60F8H      24824D

40B1 00140 MEMSAV EQU 40B1H
4113 00150 ENDPTR EQU 4113H
4115 00160 TXTPTR EQU 4115H
41C3 00170 SYMBPT EQU 41C3H
430B 00180 CURSR EQU 430BH
4617 00190 KEYIN EQU 4617H
468A 00200 ASMBEG EQU 468AH
46A2 00210 RENTRY EQU 46A2H
466C 00220 RDYADD EQU 466CH
472F 00230 WRTMSG EQU 472FH
4737 00240 LNINC EQU 4737H
4739 00250 VIDMGR EQU 4739H
48E4 00260 RDYMSG EQU 48E4H
5D00 00270 ORG 5D00H
5D00 CD065F 00280 EXTIN CALL CLSCRN ;CLR SCRIN & HOME CURSOR
5D03 21D048 00290 LD HL,48D0H ;TAPE EN/DIS ABLED MSG
5D06 CD2F47 00300 CALL WRTMSG ;WRITE MESSAGE ROUTINE
5D09 213260 00310 LD HL,PTMSG ;DISPLAYED ADDRESS HDRS
5D0C CD2F47 00320 CALL WRTMSG
5D0F 21B160 00330 LD HL,BUFBEQ ;BEG-TXT ADDRESS
5D12 CD365F 00340 CALL PTROUT ;PRINT THE HEX ADDRESS
5D15 2A1541 00350 LD HL,(TXTPTR) ;TXT-PTR ADDRESS
5D18 CD365F 00360 CALL PTROUT
5D1B 2AC341 00370 LD HL,(SYMBPT) ;SMB-PTR ADDRESS
5D1E CD365F 00380 CALL PTROUT
5D21 2A1341 00390 LD HL,(ENDPTR) ;END-TXT ADDRESS
5D24 CD365F 00400 CALL PTROUT
5D27 2A2A60 00410 LD HL,(SAVEM) ;SAV-MEM ADDRESS
5D2A CD365F 00420 CALL PTROUT
5D2D 2A1660 00430 LD HL,(BEGCD) ;BEG-CD ADDRESS
5D30 CD365F 00440 CALL PTROUT
5D33 2A1460 00450 LD HL,(LOADER) ;END-CD ADDRESS
5D36 CD365F 00460 CALL PTROUT
5D39 2A1860 00470 LD HL,(CDSIZE) ;CD-SIZE LENGTH
5D3C CD365F 00480 CALL PTROUT
5D3F CD3747 00490 CALL LNINC ;ADVANCE LINE ROUTINE
5D42 217160 00500 LD HL,CHMSG ;COMMAND CHOISE MSG
5D45 CD2F47 00510 CALL WRTMSG
5D48 CD3747 00520 GETCMD CALL LNINC
5D4B 3E2A 00530 LD A,'*'
5D4D CD0D5F 00540 CALL DSPLYA ;DISPLAY CONTENTS OF A
5D50 CDF75E 00550 CALL INKEY ;GET THE COMMAND
5D53 CD0D5F 00560 CALL DSPLYA ;DISPLAY COMMAND
5D56 FE4D 00570 CP 'M' ;<M>EMORY DUMP?
5D58 283B 00580 JR Z,MEMDMP
5D5A FE53 00590 CP 'S' ;<S>ET BREAK POINT?
5D5C CA055E 00600 JP Z,SETBRK
5D5F FE4A 00610 CP 'J' ;<J>UMP TO ASMBLD CODE?
5D61 2004 00620 JR NZ,APPRVL
5D63 CD975E 00630 CALL INPTHX ;GET JUMP ADDRESS
5D66 E9 00640 JP (HL) ;JUMP TO THAT ADDRESS
5D67 321B60 00650 LD (COMMND),A ;SAVE COMMAND
5D6A CDF75E 00660 CALL INKEY ;APPROVE COMMAND
5D6D FE0D 00670 CP 0DH ;ENTER KEY?

```

Listing continued

I wrote a modification called Extend that adds new features to version 1.2 of the Radio Shack Editor/Assembler. Extend assembles object code to memory, executes it, and returns to the Editor/Assembler. It also supports limited monitor capabilities such as setting and resetting break points. Additionally, Extend lets you display memory in hexadecimal and ASCII formats on the video monitor.

Background

This program occupies memory normally used by the Editor/Assembler for its text buffer (see the Table). Extend can reside here because it resets beginning-of-text buffer and end-of-memory pointers during its initialization process. After this process is complete, the memory occupied by the Extend initialization code becomes available to the Editor/Assembler as the start of its text buffer.

By implementing Extend in this fashion, you can use it in 16K, 32K, or 48K systems without modification. Another benefit is that the program establishes the text buffer's upper boundary at power-up. This provides the different amounts of text buffer area needed by programs depending on the amount of commented source statements.

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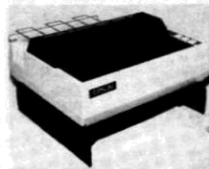
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MICROLINE 80/82A/83A/92	N/A	30.00
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Listing continued

```

5E63 3600 01760 LD (HL),00H ; --OUTPUT TO
5E65 23 01770 INC HL ; CASSETTE
5E66 3600 01780 LD (HL),00H ; CODE--
5E68 21A360 01790 LD HL,MMMSG ;CHANGE ADDRESS PNTR TO
5E6B 226C46 01800 LD (RDYADD),HL ;"LOAD TO MEMORY" MSG
5E6E 212F60 01810 LD HL,TAPENO ;MOVE "DIS" TO
5E71 11DC48 01820 LD DE,48DCH ;"EXTEND-TAPE DISABLED"
5E74 CD665F 01830 CALL MOVE3 ;MESSAGE
5E77 C3485D 01840 JP GETCMD ;GET AN EXTEND COMMAND
5E7A CD805E 01850 KILBRK CALL RSTBRK
5E7D C3485D 01860 JP GETCMD ;GET AN EXTEND COMMAND
5E80 3A1260 01870 RSTBRK LD A,(SWITCH)
5E83 CB6F 01880 BIT 5,A ;IS BRK PNT BIT SET?
5E85 280F 01890 JR Z,NOTSET ;IF 0--GET OUT
5E87 CBAF 01900 RES 5,A ;RESET BRK PNT BIT TO 0
5E89 321260 01910 LD (SWITCH),A
5E8C 212260 01920 LD HL,OLDCOD ;ADD OF OLD CODING
5E8F ED5B2560 01930 LD DE,(LOCOAD) ;WHERE TO PUT OLD CODE
5E93 CD665F 01940 CALL MOVE3
5E96 C9 01950 NOTSET RET
5E97 0604 01960 INPTX LD B,4H
5E99 111C60 01970 LD DE,HEXCHR
5E9C CDF75E 01980 GETHEX CALL INKEY
5E9F FE41 01990 CP 41H ;IF < A,
5EA1 FAAB5E 02000 JP M,CHEK09 ;MAY BE 0-9
5EA4 FE47 02010 CP 47H ;BAD IF > G
5EA6 F29C5E 02020 JP P,GETHEX
5EA9 180A 02030 JR GOODHX
5EAB FE3A 02040 CHEK09 CP 3AH ;BAD IF > 9
5EAD F29C5E 02050 JP P,GETHEX
5EB0 FE30 02060 CP 30H ;BAD IF < 0
5EB2 FA9C5E 02070 JP M,GETHEX
5EB5 12 02080 GOODHX LD (DE),A ;SAVE ASCII HEX CHAR
5EB6 13 02090 INC DE
5EB7 CD0D5F 02100 CALL DSPLYA
5EBA 18E0 02110 DJNZ GETHEX ;GET A ASCII HEX CHAR
5EBC 211C60 02120 LD HL,HEXCHR ;SET HL TO 1ST ASCII HEX
5EBF CD155F 02130 CALL ASCHEX ;CHG BYTS 1/2 TO BINARY
5EC2 321D60 02140 LD (HEXCHR+1),A ;SAVE IT AS MSB
5EC5 CD155F 02150 CALL ASCHEX ;CHG BYTS 3/4 TO BINARY
5EC8 321C60 02160 LD (HEXCHR),A ;SAVE IT AS LSB
5ECB 2A1C60 02170 LD HL,(HEXCHR)
5ECE CDF75E 02180 CALL INKEY ;PLACE IN HL
5ED1 C9 02190 RET
5ED2 C5 02200 OTPTX PUSH BC ;SAVE MEMDMP LOOP CNTRS
5ED3 7C 02210 LD A,H ;PUT MSB OF HL IN A
5ED4 CDE05E 02220 CALL FORMTA ;CHG BINARY TO ASCII HEX
5ED7 7D 02230 LD A,L ;PUT LSB OF HL IN A
5ED8 CDE05E 02240 CALL FORMTA
5EDB CD585F 02250 CALL SPACE
5EDE C1 02260 POP BC ;RSTORE MEMDMP LOOP CNTRS
5EDF C9 02270 RET
5EE0 47 02280 FORMTA LD B,A ;SAVE BINARY VALUE
5EE1 CB3F 02290 SRL A ;PUT LOW-ORDER
5EE3 CB3F 02300 SRL A ;BITS IN
5EE5 CB3F 02310 SRL A ;HIGH-ORDER
5EE7 CB3F 02320 SRL A ;POSITIONS
5EE9 D9 02330 EXX
5EEA CD4B5F 02340 CALL OTPTA2 ;PUT VAL OF A AT CURSR
5EED D9 02350 EXX
5EEE 78 02360 LD A,B ;RESTORE BINARY VALUE
5EEF E60F 02370 AND 0FH ;PRSRV LOW-ORDR BITS ONLY
5EF1 D9 02380 CALL OTPTA2 ;PUT VAL OF A AT CURSR
5EF2 CD4B5F 02390 EXX
5EF5 D9 02400 LD A,B
5EF6 C9 02410 RET
5EF7 D5 02420 INKEY PUSH DE
5EF8 C5 02430 PUSH BC
5EP9 CD1746 02440 CALL KEYIN
5EPC C1 02450 POP BC
5EPD D1 02460 POP DE
5EFE FE01 02470 CP 01H ;IF BREAK KY NOT ENTERED--
5F00 C0 02480 RET NZ ;RETURN
5F01 33 02490 INC SP ;OTHERWISE GET RID OF RET
5F02 33 02500 INC SP ;IN STACK AND
5F03 C3485D 02510 JP GETCMD ;GET NEW COMMAND
5F06 3E1C 02520 CLSCRN LD A,1CH ;HOME CURSOR
5F08 CD0D5F 02530 CALL DSPLYA ;CLEAR SCREEN
5F0B 3E1F 02540 LD A,1FH
5F0D D5 02550 DSPLYA PUSH DE
5F0E C5 02560 PUSH BC
5F0F CD3947 02570 CALL VIDMGR
5F12 C1 02580 POP BC
5F13 D1 02590 POP DE
5F14 C9 02600 RET
5F15 0E00 02610 ASCHEX LD C,0H
5F17 7E 02620 LD A,(HL)
5F18 CD225F 02630 CALL CNVERT ;CHG ASCII HEX TO BINARY
5F1B 23 02640 INC HL ;NEXT ASCII HEX CHAR
5F1C 7E 02650 LD A,(HL)
5F1D CD225F 02660 CALL CNVERT ;CHG ASCII HEX TO BINARY
5F20 23 02670 INC HL ;NEXT ASCII HEX CHAR
5F21 C9 02680 RET
5F22 CB21 02690 CNVERT SLA C
5F24 CB21 02700 SLA C
5F26 CB21 02710 SLA C
5F28 CB21 02720 SLA C
5F2A D630 02730 SUB 30H ;CHG TO 0-15
5F2C FE0A 02740 CP 10 ;CHECK IF A-F
5F2E FA335F 02750 JP M,ADDC
5F31 D607 02760 SUB 7 ;CHG A-F TO 10-15
5F33 81 02770 ADDC ADD A,C ;COMBINE VALUES IN A
5F34 4F 02780 LD C,A ;LEAVE IN C FOR NEXT TIME
5F35 C9 02790 RET
5F36 E5 02800 PTROUT PUSH HL
5F37 CD405F 02810 CALL SPACE2
5F3A E1 02820 POP HL

```

Listing continued

You are now in the Extend domain. The first line of the display tells you that the program is under the control of Extend rather than the Editor/Assembler, and that you can use cassette operations. The second and third lines consist of address designators and hexadecimal addresses.

As you enter source statements and assemble them, some of the addresses change, others don't. The first four addresses belong to the Editor/Assembler, while the last three change as a result of assembling object code to memory.

Addresses

BEG-TXT is the first memory location where the Editor/Assembler stores source statements. When you don't use Extend, this address is SCF0.

TXT-PTR is the same as BEG-TXT when there are no source statements in the text buffer. It always points to the first available memory location in the text buffer. If this address comes close to the END-TXT address and you continue to enter source statements, expect to receive the BUFFER FULL message.

SMB-PTR is the same as that of END-TXT before an assembly takes place. During the assembly process, the SMB-PTR address decreases as the assembler stores the symbols beginning at the END-TXT address and down toward lower memory. If there isn't enough memory to store the symbols between the TXT-PTR and END-TXT addresses, the assembly stops and the program displays a message indicating a symbol table overflow.

SAV-MEM is the number you entered at power-up. The area from this address through the top of RAM belongs to Extend and you can use it to store assembled object code loaded to memory. You cannot change the SAV-MEM address once the Editor/Assembler is initialized. To change it, start the Extend initialization procedure over again.

BEG-CD is the address of the first byte assembled and loaded to memory, END-CD is the address of the last byte assembled and loaded to memory, and CD-SIZE represents the number of bytes loaded to memory during an assembly.

Extend Commands

Looking at the fourth line in the sign-on message notice there are seven different commands you can enter. Three of the commands—J, M, and O—require entry of a four-digit hexadecimal number as an argument. The remaining commands are single-letter entries.

Listing continued

```

5F3B CDD25E 02830 CALL OTPTHX
5F3E 1818 02840 JR SPACE
5F40 3E20 02850 SPACE2 LD A, ' '
5F42 2A0B43 02860 OTPTA1 LD HL,(CURSR) ;RSTR CURSOR POSTION
5F45 77 02870 LD (HL),A
5F46 CD585F 02880 CALL SPACE
5F49 180D 02890 JR SPACE
5F4B 2A0B43 02900 OTPTA2 LD HL,(CURSR) ;RSTR CURSOR POSITION
5F4E C630 02910 ADD A,30H ;MAKE 0-9
5F50 FE3A 02920 CP 3AH
5F52 FA575F 02930 JP M,OTPTA3
5F55 C607 02940 ADD A,07H ;MAKE A-F
5F57 77 02950 OTPTA3 LD (HL),A
5F58 2A0B43 02960 SPACE LD HL,(CURSR) ;RSTR CURSOR POSITION
5F5B 23 02970 INC HL
5F5C 7C 02980 LD A,H
5F5D E603 02990 AND 03H
5F5F F63C 03000 OR 3CH
5F61 67 03010 LD H,A
5F62 220B43 03020 LD (CURSR),HL ;SAVE CURSOR POSITION
5F65 C9 03030 RET
5F66 010300 03040 MOVE3 LD BC,03H
5F69 EDB0 03050 LDIR
5F6B C9 03060 RET
5F6C E5 03070 LDRTN PUSH HL ;SAVE REGISTERS THAT
5F6D C5 03080 PUSH BC ;ARE PROBABLY BEING
5F6E D5 03090 PUSH DE ;USED BY THE
5F6F F5 03100 PUSH AF ;EDITOR/ASSEMBLER
5F70 57 03110 LD D,A ;SAVE BYTE FROM E/A
5F71 2A1460 03120 LD HL,(LOADER) ;RESTORE LOADING ADRS
5F74 ED4B1860 03130 LD BC,(CDSIZE) ;RESTORE PGM BYTE COUNT
5F78 3A1260 03140 LD A,(SWITCH) ;TRANSFER SWITCH BITS TO
5F7B 5F 03150 LD E,A ;TO E RGSTR
5F7C 7A 03160 LD A,D ;PUT BYTE FROM E/A IN A
5F7D CB4B 03170 BIT 1,E ;IS END-FILE BIT SET?
5F7F 203A 03180 JR NZ,EOF ;IF SET--GO TO EOF
5F81 CB43 03190 BIT 0,E ;IS START-DATA BIT SET?
5F83 200C 03200 JR NZ,CHKBYT
5F85 FE78 03210 CP 78H ;END FILE CODE?
5F87 2832 03220 JR Z,EOF
5F89 FE3C 03230 CP 3CH ;START DATA CODE?
5F8B 202C 03240 JR NZ,DONECK
5F8D CB43 03250 SET 0,E ;SET START-DATA BIT
5F8F 1828 03260 JR DONECK
5F91 CD0960 03270 CHKBYT CALL ADDTOA ;INC TIMES THRU ROUTINE
5F94 FE01 03280 CP 01H ;1ST TIME THRU?
5F96 2006 03290 JR NZ,CHKLSB ;IF NOT--SEE IF 2ND
5F98 7A 03300 LD A,D ;PUT BYTE FROM E/A IN A
5F99 321A60 03310 LD (CHKSUM),A ;SAVE--USE AS CHECKSUM
5F9C 181B 03320 JR DONECK
5F9E FE02 03330 CHKLSB CP 02H ;2ND TIME THRU?
5FA0 2003 03340 JR NZ,CHKMSB ;IF NOT--SEE IF 3RD
5FA2 6A 03350 LD L,D ;LSB OF LOAD ADDRESS
5FA3 1814 03360 JR DONECK
5FA5 FE03 03370 CHKMSB CP 03H ;3RD TIME THRU?
5FA7 2027 03380 JR NZ,LOADIT ;IF NOT--LOAD IT
5FA9 62 03390 LD H,D ;MSB OF LOAD ADDRESS
5FAA 2B 03395 DEC HL ;INC AT "LOADIT" SUBRTN
5FAB CB5B 03400 BIT 3,E ;IS ONE-TIME BIT SET?
5FAD 200A 03410 JR NZ,DONECK ;IF SET--SKIP TO DONECK
5FAF CBDB 03420 SET 3,E ;SET ONE-TIME BIT
5FB1 010000 03430 LD BC,0H ;0 BC AND USE FOR CD-SIZE
5FB4 23 03435 INC HL ;ESTB LD ADRES AGAIN
5FB5 221660 03440 LD (BEGCD),HL ;SAVE LD ADRES AS BEG-CD
5FB8 2B 03450 DEC HL ;INC AT "LOADIT" SUBRTN
5FB9 183B 03460 DONECK JR RETURN
5FBB CB4B 03470 SET 1,E ;SET END-FILE BIT
5FBD CD0960 03480 CALL ADDTOA ;INC TIME THRU ROUTINE
5FC0 FE03 03490 CP 03H ;3RD TIME THRU?
5FC2 2032 03500 JR NZ,RETURN ;IF NOT--GET OUT
5FC4 E5 03510 PUSH HL ;SAVE LOAD ADDRESS
5FC5 219860 03520 LD HL,GDLOAD ;SUCCESSFUL LOAD MSG
5FC8 CD2F47 03530 CALL WRTMSG
5FCB E1 03540 POP HL ;RESTORE LOAD ADDRESS
5FCC AF 03550 XOR A ;0-OUT SWITCH BITS
5FCD 5F 03560 LD E,A
5FCE 181C 03570 JR NOMORE ;IS END-CODE BIT SET?
5FD0 CB63 03574 LOADIT BIT 4,E
5FD2 2017 03576 JR NZ,ENDCD ;INC LOAD ADDRESS
5FD4 23 03580 INC HL ;PLACE BYTE FROM E/A
5FD5 72 03590 LD (HL),D ;AT LOAD ADDRESS
5FD6 03 03600 ;INC CD-SIZE
5FD7 3A1360 03620 INC BC ;INC BYTE COUNT
5FDA 3C 03630 INC A
5FDB 321360 03640 LD (BYTCNT),A
5FDE C5 03650 PUSH BC
5FDF 47 03660 LD B,A
5FE0 3A1A60 03670 LD A,(CHKSUM) ;BYTE COUNT = CHECKSUM?
5FE3 B8 03680 CP B
5FE4 C1 03690 POP BC
5FE5 200F 03700 JR NZ,RETURN ;NO--GET OUT
5FE7 CB63 03704 SET 4,E ;SET END CODE BIT
5FE9 180B 03706 JR RETURN
5FEB AF 03710 ENDCD XOR A
5FEC 321360 03720 LD (BYTCNT),A ;0 OUT BYTE COUNT
5FEF 321160 03730 LD (TMTHRU),A ;AND TIME THRU
5FF2 CB83 03740 RES 0,E ;RESET START-DATA BIT
5FF4 CBA3 03745 RES 4,E ;RESET END-CODE BIT
5FF6 7B 03750 RETURN LD A,E ;PUT SWITCH BITS IN A
5FF7 321260 03760 LD (SWITCH),A ;SAVE THEM
5FFA 221460 03770 LD (LOADER),HL ;SAVE LOAD ADDRESS
5FFD ED431860 03780 LD (CDSIZE),BC ;SAVE CD-SIZE
6001 F1 03790 POP AP ;RESTORE REGISTERS
6002 D1 03800 POP DE ;FOR
6003 C1 03810 POP BC ;EDITOR/

```

Listing continued

To perform a function, enter the letter (or letter and argument) and then strike the enter key. If you want to cancel the command you entered, hit the break key. In this respect, Extend commands work the same as in the Editor/Assembler. However, there is no provision in Extend to use the left-arrow key to backspace and erase. The following is a more detailed description of the commands.

The command to get back to Editor/Assembler, B, is common to both Extend and Editor/Assembler. Issuing this command while in Extend returns control to the Editor/Assembler. The opposite is true when you issue a B command while in the Editor/Assembler.

The command to enable cassette operations, C, restores code in the Editor/Assembler so you can perform cassette I/O operations. Whenever you go between the Editor/Assembler and Extend it tells you if you can perform cassette operations, since the tape enabled message appears at the top of the screen. Conversely, when the tape disabled message appears, do not attempt to invoke the W or L commands.

The command to jump to assembled code, JHHHH, consists of the letter J and a four-digit hexadecimal number. After entering the command and its argument, an unconditional branch to the argument address takes place. A note of caution—there is no restriction on the value of the argument—be careful about where you specify a jump.

The command to kill break point, K, restores the original values of the 3 bytes beginning at HHHH (memory location of the argument for the S command). The K command does not restore the values if an assembly and load-to-memory takes place after you issue the S command.

The command to dump memory to screen, MHHHH, is another command made up of the command letter followed by its argument. The M command displays 256 bytes of memory beginning with the address specified by HHHH. Each of the 16 lines follows the address of the first byte in the displayed line. This command displays bytes in both hexadecimal and ASCII representation. After the program completes a display, you must execute one of the following subcommands:

- Pressing the enter key displays the next higher 256 bytes of memory.
- !displays memory beginning 16 bytes higher than the start of the current display.
- |displays memory beginning 16 bytes

Listing continued

6004 E1	03820	POP	HL	;ASSEMBLER
6005 0E00	03830	LD	C,00	;ACCOMPLISH CODE FUNCTINS
6007 57	03840	LD	D,A	;OVERLAYED IN E/A
6008 C9	03850	RET		
6009 3A1160	03860	ADDTOA	LD	A,(TMTHRU)
600C 3C	03870	INC	A	
600D 321160	03880	LD	(TMTHRU),A	
6010 C9	03890	RET		
6011 00	03900	TMTHRU	DEFB	0H
6012 00	03910	SWITCH	DEFB	0H
6013 00	03920	BYTCNT	DEFB	0H
6014 0000	03930	LOADER	DEFW	0H
6016 0000	03940	BEGCD	DEFW	0H
6018 0000	03950	CDSIZE	DEFW	0H
601A 00	03960	CHKSUM	DEFB	0H
601B 00	03970	COMMND	DEFB	0H
0004	03980	HEXCHR	DEFS	4H
6020 0000	03990	BEGDMP	DEFW	0H
0003	04000	OLDCOD	DEFS	3H
6025 0000	04010	LOCOAD	DEFW	0H
6027 C3	04020	BRKPNT	DEFB	0C3H
6028 485D	04030	BRKADD	DEFW	GETCMD
602A 0000	04040	SAVMEM	DEFW	0H
602C 20	04050	TAPEOK	DEFB	'EN'
602D 45				
602E 4E				
602F 44	04060	TAPENO	DEFB	'DIS'
6030 49				
6031 53				
	04070	*LIST OFF		
	04190	*LIST ON		
60F8 3E0D	04200	INITLZ	LD	A,0DH
60FA CD3300	04210	CALL	033H	
60FD 21CE00	04220	LD	HL,INTMSG	;LINE ADVANCE
6100 CDA728	04230	CALL	28A7H	;DISPLAY EXTEND MSG
6103 3E0D	04240	LD	A,0DH	;WRITE IT
6105 CD3300	04250	CALL	033H	
6108 CD4900	04260	CALL	049H	;LINE ADVANCE
610B CD3300	04270	CALL	033H	;GET ANSWER
610E FE4E	04280	CP	'N'	;DISPLAY IT
6110 CA8A46	04290	JP	Z,ASMBEG	;IF N
6113 FE59	04300	CP	'Y'	;JUMP TO EDTASM INTLIZTN
6115 20E1	04310	JR	NZ,INITLZ	
6117 0612	04320	LD	B,18D	;MUST BE "N" OR "Y"
6119 219046	04330	LD	HL,4690H	;NOP 18 BYTES OF MEMORY
611C 3600	04340	ZMEMCK	(HL),0H	;IN EDTASM
611E 23	04350	INC	HL	;FROM 4690H
				;THRU 469FH

Listing continued

lower than the start of the current display.

● —displays memory beginning 1 byte higher than the start of the current display. (This and the next subcommand are useful for aligning the displayed memory addresses with the displayed bytes.)

● —displays memory beginning 1 byte lower than the start of the current display.

● B returns control to Extend's main-line processing routine where it waits to receive another command.

The command to load object code to memory is O. After you issue this command, an assembly without the /NO option in the Editor/Assembler causes object code to load to memory. The following points apply when using the O command and performing an assembly:

● Remember to use ORG statements whose operand values are equal or greater than that of SAV-MEM.

● The LOAD TO MEMORY message displays itself instead of the READY CASSETTE message. You must press the enter key for assembly to continue.

● The SUCCESSFUL LOAD TO



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```

611F 10FB 04360 DJNZ ZHEMCK
6121 21B360 04370 LD HL,EXTMSG ;REPLACE
6124 11C948 04380 LD DE,48C9H ;SIGN-ON
6127 011B00 04390 LD BC,27D ;MESSAGE WITH
612A EDB0 04400 LDIR ;THAT FOR EXTEND
612C 21005D 04410 LD HL,EXTIN ;WHERE EDTASM "B" COMMAND
612F 223049 04420 LD (4930H),HL ;WILL JUMP TO
6132 2AB140 04430 LD HL,(MEMSAV)
6135 23 04440 INC HL
6136 23 04450 INC HL
6137 222A60 04460 LD (SAVEM),HL
613A 2B 04470 DEC HL
613B 221341 04480 LD (ENDPTR),HL
613E 22C341 04490 LD (SYMBPT),HL
6141 21B160 04500 LD HL,BUFBEQ ;1ST BYTE AVLBLE FOR TEXT
6144 228B46 04510 LD (468BH),HL ;SET
6147 221147 04520 LD (4711H),HL ;ASSEMBLERS
614A 22084A 04530 LD (4A08H),HL ;BEGINNING
614D 22DC4A 04540 LD (4ADCH),HL ;OF
6150 22514B 04550 LD (4B51H),HL ;TEXT
6153 223E4D 04560 LD (4D3EH),HL ;POINTERS
6156 22854D 04570 LD (4D85H),HL ;BEYOND
6159 222C52 04580 LD (522CH),HL ;EXTEND CODE
615C C38A46 04590 JP ASMBEG
60F8 04600 END INITLZ
00000 Total Errors

H04070 *LIST OFF
04080 PTRMSG DEFM 'BEG-TXT TXT-PTR SMB-PTR END-TXT SAV-MEM BEG-CD END-CD CD-SIZ
04090 DEFB 0C5H
04100 CHGMSG DEFM 'ENTER EXTEND COMMAND--B,C,J,K,M,O, OR '
04110 DEFB 0D3H
04120 GDLOAD DEFM 'SUCCESSFUL'
04130 MEMMSG DEFM 'LOAD TO MEMOR'
04140 DEFB 0D9H
04150 BUFBEQ DEFW 0FFFFH
04160 EXTMSG DEFM 'EDTASM/EXTEND-TAPE ENABLE'
04170 DEFB 0C4H
04175 INTMSG DEFM 'DO YOU WISH TO USE EXTEND (ENTER Y OR N)?'
04180 DEFB 00H
04190 *LIST ON

```

MEMORY message displays itself when assembly is done.

●Be patient. Assembling to memory takes a little longer than creating a system tape of the same object code.

●The O command disables cassette operations while it is set. Be sure to issue an Extend C command before attempting a W or L command with the Editor/Assembler.

"Since there is no restriction on the value of the argument, be careful about where you specify a jump."

Set break point SHHHH. This command and its argument causes Extend to place an unconditional branch (at the address specified by HHHH) back to Extend. It saves the 3 bytes replaced by the break point code, and restores byte values to their former memory location by either the K command or another S command. The break point is not in effect if a load object code to memory takes place after setting the break point. Caution—the command makes no check of the argument value. Results are unpredictable if you set break points within the areas of the Editor/Assembler or Extend. ■

Robert Fleck is employed by Defense Logistics Agency Systems Automation Agency, and lives at 22480 Collier Ave., Battle Creek, MI 49017.

```

0000 hex -----
                        Basic ROM/RAM
4100 hex -----
                        Basic and free RAM used by EDTASM
4300 hex -----
                        EDTASM code
5D00 hex -----
                        Extend code
60B1 hex -----
Extend initialization code (overlayed by text buffer)
                        EDTASM text buffer
                        ||
                        EDTASM symbol table
SAV-MEM -----
Available for assembled object code loaded to memory
High-Memory -----

```

Table. EDTASM/Extend memory usage.

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Prime Mission

Jeffrey O. Fisher

Prime numbers are cardinal numbers divisible only by their respective selves and 1, and include 1,2,3,5,7,11,13,17,19....

The object of the game Prime Mission is simple: The vicious prime numbers have launched an attack against the Earth, and Earth Command, an international council, is appointed to wage war against the marauders. Earth Command orders you to control their latest weapon: a laser base moving continuously across the bottom of the screen. You cannot stop the base, but you can change its direction of movement and fire the laser at will.

Your commands are simple:

- If the base is moving to the left, change direction with the / key.
- If the base is moving to the right, change direction with the Z key.

Vicious prime numbers are attacking Earth. Can you meet their challenge and save the planet?

- To fire the vertical laser, press the space bar.

The prime numbers' weapon, the Kamikaze 7 ship (or 7-ship), attempts to collide with your laser base, destroying it and you.

You have ten laser shots; you get another shot for each Kamikaze 7-ship you hit.

Playing the Game

With the program in memory, type Run. The program asks the maximum

number of kamikaze ships you want on the screen at any time (1-10). The program displays the title and gives playing instructions. Press the space bar when the words "Prime Mission" are displayed to bypass the instructions.

The lower left corner of the screen displays your score, equal to ten times the number of ships you hit. Next to the scoreboard is the total number of shots remaining; the right side of the

The Key Box

Model I and III

16K RAM

Cassette or Disk Basic

```
100 CLS:PRINT"ENTER THE MAXIMUM NUMBER OF KAMIKAZE":INPUT"SHIPS
YOU WANT AT ANY ONE TIME (1-10)";C:IF C<10 OR C>10 THEN 100 ELSE C=INT(C)
110 ES=CHR$(179)+CHR$(140)+CHR$(179)
120 BS=CHR$(184)+CHR$(191)+CHR$(180):CLS:PRINTCHR$(23);TS="P R
I M E M I S S I O N":FOR K=1 TO 447:KSTEP 64:PRINT
TL:MID$(TS,K,1);AS=INKEY$:IF AS=" " THEN 160 ELSE PRINT@,":NEX
TL:PRINT@,MID$(TS,K,1):NEXT K:PRINT"BY JEFF FISHER"
120 FOR K=1 TO 200:AS=INKEY$:IF AS=" " THEN 160 ELSE NEXT K:CLS:PRINT"THE
EVIL PRIME NUMBERS HAVE INVADED!!":PRINT"AND THEY HAVE THEIR N
EW 'KAMIKAZE 7' SHIPS!":PRINT"THEY PLAN TO DESTROY HUMANITY BY I
NVESTING EARTH!":PRINT
130 PRINT" EARTH COMMAND HAS GIVEN YOU A LASER BASE ";BS;" A
ND TEN SHOTS":PRINT"TO DESTROY AS MANY AS YOU CAN. THE BASE IS
UNDER CONTINUAL":PRINT"MOVEMENT. HOWEVER, YOU CAN ALTER THE DIREC
TION OF TRAVEL BY"
140 PRINT"PRESSING 'Z' TO MOVE LEFT AND '/' TO MOVE RIGHT.":PRIN
T"THE HIGHER THE VALUE OF THE PRIME NUMBER, THE GREATER":PR
INT"THE NUMBER OF POINTS YOU SCORE. YOU MUST BE DIRECTLY UNDER"
:PRINT"THE NUMBER TO HIT IT. TO FIRE, PRESS THE SPACE BAR. A"
150 PRINT"KAMIKAZE 7 SHIP COUNTS AS A FREE SHOT.":PRINT" THE
GUNNER WITH THE HIGHEST SCORE WILL BE REMEMBERED":PRINT"BY A RE
CORD OF HIS MEMORABLE SKILL.":PRINT:INPUT"PRESS 'ENTER' TO BEGIN
PLAY":AS
160 CLS:PRINT@1000,CHR$(94);G=G+1:FOR K=1 TO C:K=1:NEXT K:R=10:N
=0:F=10:S=0:I=1:P=995+RND(61):GOSUB 370
170 IF P=896 THEN I=1:PRINT@1000,CHR$(94);ELSE IF P=957 THEN I=-1:PRIN
T@1000,CHR$(93);
180 P=P+1:PRINT@,":PRINT@P,BS;FOR J=1 TO C:IF P(J)<0 THEN NEXT J
190 IF J=C+1 THEN 240
200 A=P(J) AND 63:B=P+LAND 63:IFA=B THEN P(J)=P(J)+61+RND(2) ELSE IFA<B
THEN P(J)=P(J)+64+RND(2) ELSE P(J)=P(J)+62+RND(3)
```

```
210 IF P(J)>959 THEN PRINT@0(J),":P(J)--1:GOTO 230
220 PRINT@0(J),":PRINT@P(J),":O(J)=P(J):IF P(J)=PORP(J)=P+1
OR P(J)=P+2 THEN FOR K=1 TO 5:PRINTCHR$(23);FOR L=1 TO 10:NEXT L:PRINTCHR
$(28);NEXT K:PRINT@256,"YOU HAVE BEEN DESTROYED BY A KAMIKAZE 7!
":GOSUB 370:GOTO 380
230 NEXT J
240 AS=INKEY$:IF AS=" " AND P=896 THEN I=-1:PRINT@1000,CHR$(93);ELSE
IFA=" " AND P=956 THEN I=1:PRINT@1000,CHR$(94);
250 IFA<>" " THEN 320
260 PRINT@975,"[";D=0:FOR J=1 TO C:IF (P(J) AND 63)=(P+LAND 63) AND P(J)
>P(D) THEN D=J
270 NEXT J:IF D<>0 THEN S=S+70:U=P(D):ELSE U=0:S=S+10*(15 AND PEEK(1446
5+P))
280 FOR K=P-63 TO STEP 64:PRINT@K,CHR$(191);NEXT K:IF U=0 THEN FOR L=1 T
O 5:PRINT@P(D)-L,ES;PRINT@P(D)-1,"":NEXT F=F+1
290 FOR K=P-63 TO STEP 64:PRINT@K,"":NEXT K:IF U=0 THEN P(D)--1
300 PRINT@975,"[";F=F-1:GOSUB 370
310 IF F=0 THEN 380
320 O=P:FOR J=1 TO C:N=N+1+RND(3):IF N>61 THEN N=N-62
330 IF P(J)<0 AND RND(8)=1 THEN PRINT@N,"[";O(J)=N:P(J)=N:ELSE PRINT@
N,RND(3);
340 NEXT J
350 IF R>2 THEN R=R-.1
360 GOTO 170
370 PRINT@960,"SCORE:";S;PRINT@980,"SHOTS LEFT:";F;PRINT@1006,
"TOP SCORE:";H;RETURN
380 PRINT@448,"MISSION";G;"OVER":PRINT:IF S>H THEN PRINT"CONGRATULA
TIONS!":PRINT"YOU HAVE POSTED A NEW HIGH SCORE!":H=S
390 PRINT"CARE TO PLAY AGAIN (Y/N)?":GOSUB 370
400 AS=INKEY$:IFA=" " THEN 400 ELSE IFA="Y" THEN 160 ELSE IFA="N" THEN P
RINT@384,"THANKS FOR PLAYING!":ELSE 400
```

Program Listing. Prime Mission.

screen shows the highest score achieved during a mission so far.

Movement slows when you fight more than one kamikaze ship at a time. The computer acknowledges a "fire" command with an up arrow (↑); after firing, the arrow is erased. A right or left arrow at the bottom of the screen indicates the direction the laser base is traveling.

Prime numbers appear across the top of the screen from left to right. Occasionally a 7-ship descends on the laser base like a kamikaze. Launch laser salvos on the attacking 7-ships and dodge those you cannot destroy. You may attack the numbers at the top of the screen to score points.

The game ends when you exhaust your supply of shots or when a Kamikaze 7 destroys your base. You may begin a new mission at your discretion.

There is no perfect score; your goal is to better the top score. You may choose to attack the 7-ships and hope that any missed shots hit a prime number.

The program uses 7-ships because of their maneuverability and unpredictability; destroying one is difficult.

Variables

Table 1 lists all program variables.

A variable determines the probability of 7-ship creation. Line 160 sets the variable R to 10; the random number function RND(R) picks an integer from 1 to the greatest integer in R. If the array P(n) is not full and RND(R) picks the number 1, the program creates a 7-ship.

As the program continues R decreases, narrowing the choice of integers. RND(R) chooses the number 1 more often, generating more 7-ships; ultimately, the 7-ship is created as often as it is not. The array P(n) remains nearly always full and the game places 7-ships randomly on the screen. You finally cannot simply avoid the 7-ships, and must plan a strategy of defense.

A unidimensional array P(n) keeps track of the Kamikaze 7 ships, where n ranges from one to the maximum number of ships possible (see Fig. 1). If P(n) has a value greater than or equal to zero it indicates the position of the 7-ship on the screen. If P(n) equals -1 it is empty and can be filled with a ship.

The program erases a moving 7-ship from its current position before putting it in a new position. The array

O(n) keeps track of the previous position of the corresponding ship in the array P(n). After the program calculates the new position and stores it in P(n), it uses O(n) to erase the ship. The value in P(n) is used to place the ship back on the screen in its new location. An almost negligible amount of time passes between the two actions, giving the TRS-80 the equivalent of smooth movement.

The And function determines whether two objects on the screen are in the same column. Screen position 269 is directly above 525; 525 minus 269 equals 256. Divide 256 by 64; the quotient equals 4, an integer. Four lines separate positions 525 and 269.

The And function compares two bits (binary digits of either zero or 1). If both of the bits are 1, the And function yields a 1; all other cases result in a zero (see Fig. 2).

A and B are the bits compared; the result is F. Read the first line of Fig. 2 as "zero Anded with zero is zero."

Numbers greater than 1 are represented as a string of bits. For example, 10₂ equals 2 and 11₂ equals 3, where the subscript two indicates that the number is shown in base two (see

A	B	F
0	0	0
0	1	0
1	0	0
1	1	1

Figure 2. Truth table.

Appendix G of the *Level II Basic Reference Manual*, and chapter two of *Programming Techniques for Level II Basic* by William Barden Jr.).

Numbers of more than one bit are

String Variables

- A\$ INKEY\$ user's commands.
- B\$ graphic characters for the laser base.
- E\$ graphic characters indicating the explosion of a 7-ship.
- T\$ title of the game.

Numeric Arrays

- O(n) contains position of all 7-ships. Used to erase a ship from the screen immediately before movement.
- P(n) contains position of all attacking 7-ships.
- Note: in both cases, n is an integer varying from one to the maximum number of attacking 7-ships.

Numeric Variables

- A,B used to generate the offensive moves of the 7-ships. A is the number of spaces a 7-ship is from the left of the screen; B is the number of spaces the laser base is from the left of the screen.
- C maximum number of attacking 7-ships.

- D contains value of i in the array P(i) that represents a destroyed 7-ship. The obliterated ship is banished from the array.
- F number of laser shots left.
- G number of games played.
- H highest score achieved in game session.
- I controls the direction of base movement. I = 1 if base is moving to the right and I = -1 if base is moving to the left.
- J,K,L used for iterative (For...Next) loops.
- N used to print prime numbers at the top of the screen.
- O position of laser base before move. Used to erase it from the screen immediately before the move.
- P current position of the laser base.
- R scaling of random number generator. Determines the likelihood of a 7-ship appearing when space is available for one in the array P(n).
- S player's current score.

Table 1. Variables and functions.

Array Subscripts	0	1	2	...	C	n
Not Used	-1	396	...	555	P(n)	

Figure 1. The array P(n). Values of -1 indicate that the ship does not exist; other values represent that ship's position on the screen.

compared bit-for-bit according to their position with reference to the radix point (the general equivalent of the base-ten decimal point). For example, 1010₂ Anded with 1100₂ is 1000₂ with the radix point understood to be at the extreme right.

A position on the screen is an integral multiple of 64 (the number of lines down the screen) plus some remainder. If two positions have the same remainder they are in the same column. The And function strips off everything except the remainder, any

integer from 0 to 63. It is then simple to compare the two remainders.

Take the numbers that we know are in the same column on the screen: 269 and 525. Apply the And function to each of them with 63 and compare the remainders:

```

269 = 01000011012
AND 63 = 00001111112
-----
13 = 00000011012

525 = 10000011012
AND 63 = 00001111112
-----
13 = 00000011012

```

As you see, the remainders are equal and the two numbers are in the same column.

The And function also determines the amount to add to the score when the laser misses a 7-ship. The PEEK function looks at the memory location corresponding to the place where the laser strikes the top row of numbers and retrieves the ASCII equivalent of what resides at that place on the screen. (A list of alphanumeric characters and their ASCII equivalents is given in Appendix C in the *Level II Basic Reference Manual*.) The decimal equivalents of the ASCII 1, 2, and 3 are respectively 49, 50, and 51. Any of these numbers Anded with 15 (= 1111₂) gives the binary value. The program takes this result, multiplies it by 10 and adds it to the current score. If the laser strikes a blank space the Anded value is zero.

Remarks and Changes

When a 7-ship explodes it may obscure an adjacent 7-ship with scattering debris. You can destroy no more than one 7-ship with one shot even if two or more 7-ships occupy the same spot.

This game has a maximum of 10 attacking 7-ships (based on O(n) and P(n) arrays). If you should want more than 10, alter the program slightly by enlarging the array.

Suppose you want as many as 30 7-ships descending upon you. Add the following line: 10 DIM O(30), P(30) and change IFC>10 in line 100 to IFC>30. However, fighting 30 7-ships can make movement almost unbearably slow. ■

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Line(s)	Description	
100	lets user determine the maximum number of ships on the screen and assigns the graphic string for the simulation of exploding 7-ships.	line of fire, explodes it, turns it off in the array P(n), and adds 70 points to the score. Adjusts the score if the laser hits a prime at the top of the screen.
110	assigns the graphic string for the laser base, displays the title of the game and the author's name.	310 terminates game if all shots are fired.
120-150	delays for title page and gives instructions. The user must press Enter to begin play.	320-340 generates random prime numbers and the 7-ships.
160	clears the screen, initializes the variables (so the game begins with no 7-ships) and the display.	350 decreases the scaling factor for the generation of 7-ships. This makes it more likely that 7-ships will appear whenever space is available in the array P(n).
170	switches the direction of laser base movement if it reaches the edge of the screen.	360 goes to line 170 for the next movement and command.
180-200	moves the laser base and checks for existing 7-ships to determine their offensive moves.	370 displays the current score, number of laser shots left, and the highest score so far.
210	erases an attacking 7-ship that has moved off the display.	380 tells the player that the mission is over and congratulates him if he has achieved the highest score so far.
220	moves the 7-ship and informs the player if he has been destroyed.	390 queries the player if he would like to play again.
240	sets the variable I to -1 or 1 according to keyboard input. Also changes the direction arrow to reflect movement of the base.	400 waits for player to decide whether or not he wants to play another game. If so, the program then continues execution at line 160. Otherwise, the user is thanked and the program terminates execution.
250-300	finds the closest 7-ship in the	

Note: In the listing the up-arrow is represented as a left square bracket (⌈).

Table 2. Program description.

MIKROKOLOR

TRS-80* MODEL 100 COLOR GRAPHICS

High resolution color graphics for graphs, charts, games, animation, business applications, teaching, scientific display. Allows full sized color text and graphics as featured in 80 Micro magazine, May & June 1983.

Display on any sized Color Monitor or Color TV with modulator.

256 x 192 Color Graphics - 15 colors plus transparent. 3 dimensional Sprite planes - Simultaneous display of planes.

4 Modes of operation available:

1. TEXT: 24 lines - 40 characters per line, 6 x 8 matrix, 256 user defineable characters.
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4. GRAPHICS 2: Same as Graphics 1 except 16 colors per character.

SPRITES: Active in all but text mode, 32 prioritized 3-D planes, 15 colors plus transparent, easily provides animated graphics with simultaneous display of all sprites. Composite Video Output (NTSC). Comes with sample programs and instructions. No hardware modifications necessary, plugs into expansion socket. Uses Texas Instruments TMS9918A Video Display Processor. On board RAM uses no system memory space.

User manual only - \$5.00. Money Order, COD, checks or credit card. Personal checks must clear. COD add \$2.00. Visa, Mastercard add 4%. Calif. residents add 6% sales tax. DEALER INQUIRIES INVITED.

\$235.00 Assembled and tested.

\$195.00 Kit, with instructions

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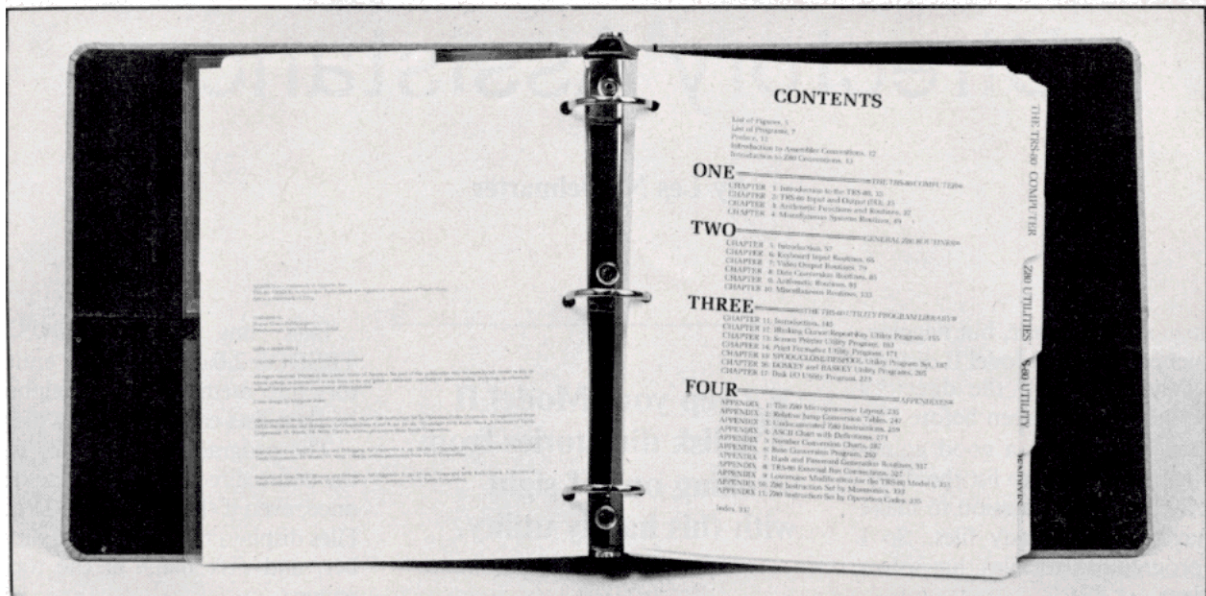
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✓172

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You'll also learn about disk operating systems, device handling, base conversion, parameter passing, and more.

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Directory Assistance

by Les N. Delmarter

I'm plagued by a minor, but nagging, inconvenience with the Model II disk directory. When I call it, the directory display scrolls off the screen before I've had a chance to give it a good going-over. Sometimes I have to list the directory several times in succession to make sure I haven't missed any files. So I wrote a program called Files that solves the problem.

Keep your Model II disk directories from scrolling out of sight with this handy utility.

Program Listing 1. Files source code.

```
.Mon      00000 000.38.19 00
00010 ;      "FILES" DIRECTORY SORTING/LISTING PROGRAM.
00020 ;      WRITTEN FOR THE TRS-80 MODEL II BY
00030 ;      LES DELMARTER, OWNER
00040 ;      CUSTOM SOFTWARE SERVICES
00050 ;      P.O. BOX 150
00060 ;      PORTERVILLE, CA 93258
00070
00080
00090
00100      ORG      7000H
00110 FILES   LD      HL,2701H;      FIND SPACE FOLLOWING PROGRAM
00120          LD      DE,SPC;      NAME.
00130          LD      B,1
00140          LD      A,49;      SEARCH SUPERVISOR CALL.
00150          RST      8
00160          JR      Z,SK;      NO SPACE. SKIP TO NEXT ROUTINE.
00170          XOR      A
00180          ADD     A,30H;      CONVERT TO ASCII CODED HEX.
00190          JR      CONT
00200 SK      INC     HL;      CHECK FOR DRIVE SPEC.
00210          LD      A,(HL)
00220          CP      '4'
00230          JR      NC,SEP;      CHECK FOR SEPERATOR.
00240 CONT     LD      (DRIVE),A;      SAVE DRIVE NUMBER.
00250          CP      0;      IS DRIVE SPEC IN BINARY ?
00260          JR      Z,BYP;      YES.
00270          SBC     A,30H;      NO. CONVERT.
00280 BYP     LD      B,A;      PUT DRIVE SPEC IN B.
00290          LD      C,0;      RANDIR FUNCTION SWITCH.
00300          LD      HL,BUFFER
00310          LD      A,53;      RANDIR SVC.
00320          RST      8
00330          JR      NZ,ERROR;      ERROR OCCURED.
00340          CALL    DISKID;      GET DISK ID INFO.
00350          CALL    SORT;      SORT DIRECTORY.
00360          CALL    HEAD;      CLS, DISPLAY HEADING.
00370          LD      HL,BUFFER
00380 LP      LD      A,(HL);      CHECK FIRST CHARACTER.
00390          CP      ' ';      IS IT BLANK ??
00400          JR      Z,SKIP;      YES. SKIP OVER IT.
00410          CP      ' ';      IS IT A VALID ENTRY ??
00420          JR      NZ,END;      NO. END
00430          INC     HL;      BUMP POINTER.
00440          CALL    FIND;      FIND CARRIAGE RETURN.
00450          LD      B,15;      DISPLAY IT.
00460          LD      C,20H
00470          LD      A,9
00480          RST      8
00490          JR      NZ,ERROR
00500 SKIP     LD      BC,0033;      INCREMENT POINTER
00510          ADD     HL,BC;      TO NEXT DIRECTORY SLOT.
00520          LD      DE,(TOP);      GET ENDING ADDRESS FOR DIR
00530          SBC     HL,DE;      BUFFER. IS CURRENT POINTER
00540          JR      NC,LP;      LARGER ??
```

Listing 1 continued

Files runs under TRSDOS 2.0 or TRSDOS 2.0a. It loads the entire directory into memory, sorts it alphabetically, then lists each file on the display.

The program lists only file names so the entire directory fits on the display at once, even if the disk is full. In addition, Files displays the date, time, drive number, and disk name at the top of the screen.

Creating Files

To create the program, enter the source code into an editor/assembler if you have one. Otherwise, enter the object code directly, using the Model II's Debug feature. I'll discuss both methods.

Editor/Assembler Method

Program Listing 1 contains the Files source code. The program resides at 7000 hexadecimal (hex), so you can run it on either a 32K or 64K Model II without modification.

Debug Method

Program Listing 2 provides the object code you can enter with Debug. At the TRSDOS READY prompt, type DEBUG ON and press the enter key. Then type DEBUG and press the enter key a second time.

Press the M key, type 7000, and press the enter key. Then hit the F1 key and

The Key Box

**Model II
64K RAM
Assembly Language
MII Editor/Assembler or Debug
TRSDOS 2.0 or 2.0a**

```

00550      JR      END;
00560 ERROR LD      B,A;
00570      LD      A,39;
00580      RST      8;
00590 END    RST      0;
00600 SEP    CP      ':';
00610      JR      NZ,BAD;
00620      INC      HL;
00630      LD      A,(HL);
00640      CP      '4';
00650      JP      C,CONT;
00660 BAD    LD      A,48;
00670      JR      ERROR;
00680 FIND  PUSH     HL;
00690 LP1    INC      HL;
00700      LD      A,(HL);
00710      CP      ':';
00720      JR      NZ,LP1;
00730      LD      (HL),20H;
00740      INC      HL;
00750      LD      (HL),20H;
00760      INC      HL;
00770      LD      (HL),20H;

00780      POP      HL;
00790      RET
00800 SORT  LD      HL,BUFFER;
00810 LP2    LD      A,(HL);
00820      CP      '0';
00830      JR      Z,FOUND;
00840      LD      BC,0034;
00850      ADD      HL,BC;
00860      LD      A,(COUNT);
00870      DEC      A;
00880      LD      (COUNT),A;
00890      JR      NZ,LP2;
00900      JR      ERROR;
00910 FOUND LD      BC,0034;
00920      SBC      HL,BC;
00930      PUSH     HL;
00940      POP      DE;
00950      LD      IX,BUFFER;
00960      LD      B,1;
00970      LD      C,34;
00980      LD      H,0;
00990      LD      L,15;
01000      LD      A,56;
01010      RST      8;
01020      RET
01030 HEAD LD      BC,0101H;
01040      LD      A,7;
01050      RST      8;
01060      JR      NZ,ERROR;
01070      CALL     DATE;
01080      LD      HL,MSG1;
01090      LD      B,MSG1X-MSG1;
01100      LD      C,0;
01110      LD      A,9;
01120      RST      8;
01130      JR      NZ,ERROR;
01140      RET
01150 DATE  LD      HL,B1;
01160      LD      B,0;
01170      LD      A,45;
01180      RST      8;
01190      JP      NZ,ERROR;
01200      LD      HL,B1;
01210      LD      DE,DT;
01220      LD      BC,0003H;
01230      LDIR
01240      LD      HL,B1+3;
01250      LD      DE,DT+4;
01260      LD      BC,0003H;
01270      LDIR
01280      LD      HL,B1+6;
01290      LD      DE,DT+9;
01300      LD      BC,0002H;
01310      LDIR
01320      LD      HL,B1+8;
01330      LD      DE,DT+12;
01340      LD      BC,0004H;
01350      LDIR
01360      LD      HL,B1+15;
01370      LD      DE,DT+21;
01380      LD      BC,0008H;
01390      LDIR
01400      RET
01410 DISKID LD      HL,ID;
01420      LD      A,(DRIVE);
01430      SUB      30H;
01440      LD      B,A;
01450      LD      A,15;
01460      RST      8;
01470      JP      NZ,ERROR;
01480      RET
01490 MSG1  DEFB    1AH;
01500      DEFM    'SORTED DIRECTORY LIST';
01510 DT     DEFM    ' ';
01520 ID     DEFM    ' ';
01530      DEFM    'DRIVE';
01540 DRIVE DEFB    30H;
01550      DEFM    ' ';
01560      DEFB    19H;
01570 MSG1X EQU      $;
01580 SPC    DEFB    20H;
01590 COUNT DEFB    97;
01600 TOP    DEFW    0;
01610 B1     DEFS    26;
01620 BUFFER DEFB    0;
01630      END      FILES

```

YES. END.
MOVE ERROR CODE TO B.
DISPLAY ERROR CODE.

JP TO TRSDOS READY.
WAS COLON IN DRIVE SPEC ??
NO. BAD DRIVE SPEC.
YES. BUMP POINTER.
NEXT CHARACTER SHOULD BE
LESS THAN 4.
OK. CONTINUE.
NO. BAD DRIVE SPEC.
DISPLAY ERROR CODE 48.
SAVE POINTER.
BUMP POINTER.
CHECK CHARACTER IN HL.
IS IT A COLON ??
NO. GO AGAIN.
YES. REPLACE IT WITH A BLANK.
BUMP POINTER.
REPLACE DRIVE # WITH BLANK.
BUMP POINTER.
REPLACE CARRIAGE RETURN WITH BLANK.

RESTORE POINTER.

SORT ENTRIES IN RAM.
FIND END OF DIRECTORY IN BUFFER.
*# MARKS END OF DIRECTORY.
FOUND IT. CONTINUE.
BUMP POINTER BY 34 BYTES.

BUMP COUNT.

SAVE COUNT.
SHOULD NEVER BE ZERO.

MOVE POINTER TO
START OF LAST DIR. ENTRY.
TRANSFER TO DE.

SET UP REGISTERS FOR SORT.

CLS, 80 CHAR/NORMAL MODE.

SET UP DATE IN BUFFER.
DISPLAY HEADING.

GET DATE/TIME INTO BUFFER B1.

TRANSFER TO MESSAGE BUFFER.

REVERSE VIDEO CODE.

NORMAL VIDEO CODE.



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```

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7010 18 06 23 7E FE 34 30 49 32 69 71 FE 00 28 02 DE
7020 30 47 0E 00 21 8A 71 3E 35 CF 20 30 CD 0A 71 CD
7030 81 70 CD AF 70 21 8A 71 7E FE 20 28 11 FE 3A 20
7040 1F 23 CD 70 70 06 0F 0E 20 3E 09 CF 20 0E 01 21
7050 00 09 ED 5B 6E 71 ED 52 30 DE 18 04 47 3E 27 CF
7060 C7 FE 3A 20 07 23 7E FE 34 DA 18 70 3E 30 18 EC
7070 E5 23 7E FE 3A 20 FA 36 20 23 36 20 23 36 20 E1
7080 C9 21 8A 71 7E FE 23 28 0F 01 22 00 09 3A 6D 71
7090 3D 32 6D 71 20 EE 18 C4 01 22 00 ED 42 E5 D1 DD
70A0 21 8A 71 06 01 0E 22 26 00 2E 0F 3E 38 CF C9 01
70B0 01 01 3E 07 CF 20 A5 CD C7 70 21 1A 71 06 52 0E
70C0 00 3E 09 CF 20 96 C9 21 70 71 06 00 3E 2D CF C2
70D0 5C 70 21 70 71 11 36 71 01 03 00 ED B0 21 73 71
70E0 11 3A 71 01 03 00 ED B0 21 76 71 11 3F 71 01 02
70F0 00 ED B0 21 78 71 11 42 71 01 04 00 ED B0 21 7F
7100 71 11 4B 71 01 08 00 ED B0 C9 21 57 71 3A 69 71
7110 D6 30 47 3E 0F CF C2 5C 70 C9 1A 20 53 4F 52 54
7120 45 44 20 44 49 52 45 43 54 4F 52 59 20 4C 49 53
7130 54 20 20 20 20 20 20 20 20 20 20 20 20 20 20
7140 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
7150 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
7160 20 20 20 44 52 49 56 45 20 30 20 19 20 61 00 00
7170 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

```

Program Listing 2. Files object code.

enter the code in Listing 2. When the code fills the display area, press the F2 key to store the code you entered.

Press the M, down-arrow, and F1 keys. This moves Debug to the next 80-byte display block so you can con-

tinue entering the code in Listing 2.

When you've entered all the code, press the F2 key to exit the edit mode, then press the O key to exit Debug.

At the TRSDOS READY prompt, type DEBUG OFF and press the enter

key. Then type DUMP FILES START = 7000, END=7177, TRA=7000 and press the enter key.

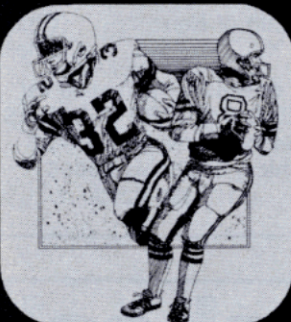
Using Files

To use Files, type FILES at the TRSDOS READY prompt and press the enter key. The program displays the files in drive zero. If you want the directory of a disk in another drive, type FILES followed by a space and the number of the drive (zero to 3). For example, to list the files in drive 1, type FILES 1.

Alternatively, you can call Files from Basic using the command SYSTEM "FILES" or a similar statement in your Basic program. However, doing so wipes out any Basic program in memory because the Files program resides in the same area of memory as a Basic program would.

To solve this problem, you must have a 64K Model II with an editor/assembler. Specify an origin address of F000 rather than 7000 to store Files above user memory, out of the way of any Basic program. ■

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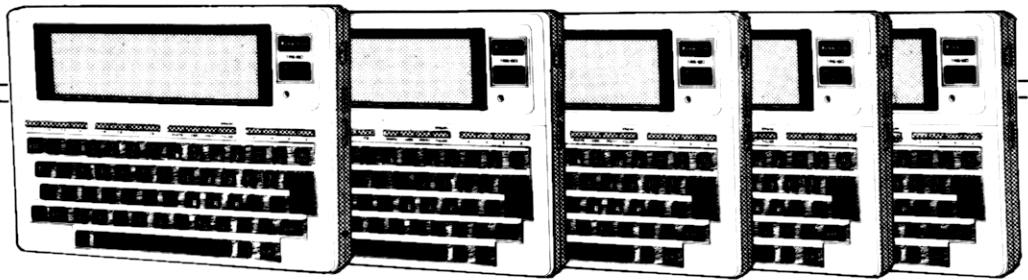
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Nag Analysis

Conversion by Mare-Anne Jarvela
80 Micro Technical Editor

If you've got an eye for the horses, bring your Model 100 to the race track and make big bucks.

This conversion (Program Listing 1) of Dave Crosby's program Nag Analysis (80 Micro, July 1981, p. 243) rates horses by a handicapping system. My conversion runs in 8K RAM.

You enter information about the horse: days between races, race distance, class, gain in stretch, call positions, jockey's weight, speed rating, and earnings, and the horse is given a number rating for each category. After all the information is entered, the score is totaled. Either enter the number of another horse you want evaluated or press the zero key.

When you hit the zero key, the question "Do you want to see a list?" appears. Enter Y and the rating list appears on the screen. If you also want a printout, answer Y to the next question. When you answer the date prompt, you need only enter the day, not the month and year.

If the horse hasn't raced in the last 15 days, the program automatically eliminates it. If the horse has been in a race within 15 days, the program awards it 10 points. Enter the distance: 8 for eight furlongs, 2 for two miles, 4.16 for 4 1/16, and so on. If the distance is the same for both this race and the last, the program adds 10 points to the total score. The class question asks for the horse's claim for this race and the previous race. The horse is awarded points if the difference between races is significant. Stretch gain for the horse's last three races receives 10 points.

When you answer the call position question, remember that it's for the last three races (any calls). If the horse came in first five times, enter 5. A first call is worth 10 points and a second call five. Again, 10 points if the jockey's weight stays the same both races.

After you enter the last three speed ratings, the program

averages them and assigns points accordingly. The last question is about the earnings for the year. The program divides earnings by the number of starts the horse made, and awards the appropriate number of points.

The total score appears on the screen for the post position that you entered and is written to the NAG.DO file. The NAG.DO file also contains all of the post positions and the scores. To rate another horse, enter a new post position number. By loading the NAG.DO file you can get a list of all of the horses on the screen. The NAG.DO file stays the same until the next time you start the program.

Bet on the horse with the highest score and hope to win. ■

Program Listing 1. Nag Analysis.

```

10 'HORSES
20 MAXFILES=2: CLEAR:CLS:N=0
30 INPUT"TODAYS DATE ";A
40 INPUT"DAYS IN PREVIOUS MONTH ";C
50 INPUT"TODAYS DISTANCE ";B:J=0:L=15
60 INPUT"POST # ";E:IF E=0 THEN 510
70 IF E>15 THEN 60
80 D=0:IF E>J THEN LET J=E
90 IF E<L THEN LET L=E
100 CLS:PRINT"DAYS BETWEEN RACES "
110 INPUT"LAST RACE DAY ";F:G=A
120 IF F>G THEN LET G=G+C
130 IF (G-F)>15 THEN PRINT"ELIMINATED":
GOTO 60
140 I=10:GOSUB 480
150 INPUT "DISTANCE LAST RACE ";R
160 IF R=B THEN LET I=10:GOSUB 480:GOTO 180
170 GOSUB 500
180 CLS:PRINT"CLASS CHECK"
190 INPUT"TODAYS CLAIM";S
200 INPUT"LAST CLAIM ";G
210 I=INT ((G-S)/10+.5):GOSUB 480
220 CLS:INPUT"GAIN IN STRETCH (Y/N)";K$
230 IF K$="Y" THEN LET I=10:GOSUB 480:GOT
O 250
240 IF K$="N" THEN GOSUB 500 ELSE GOTO 220
250 CLS:PRINT"RUNNING POSITION"
260 INPUT"1ST ANY CALL ";U
270 INPUT"2ND ANY CALL ";V
280 I=U*10+V*5:GOSUB 480
290 CLS:PRINT"ASSIGNED WEIGHT"
300 INPUT"JOCKEY'S WEIGHT THIS RACE ";WT
310 INPUT"JOCKEY'S WEIGHT LAST RACE ";WL
320 IF WT=WL THEN LET I=10:GOSUB 480:GOTO 34
0
330 GOSUB 500
340 CLS:PRINT"LAST 3 SPEEDS"
350 INPUT "FIRST ";XF
360 INPUT "SECOND ";XS
370 INPUT "THIRD ";XT
380 I=INT ((XF+XS+XT)/3+.5):GOSUB 480
390 CLS:PRINT"AVERAGE EARNINGS"
400 INPUT"YEARS EARNINGS ";Z

```

Listing 1 continued

N	Counter	U	First any call
A	Today's date	V	Second any call
C	Days last month	WT	Weight this race
B	Today's distance	WL	Weight last race
E	Post number	XF	First speed
D	Total points awarded	XS	Second speed
F	Last race day	XT	Third speed
I	Awarded points	Z	Year's earnings
R	Distance last race	Y	Number of starts
S	Today's claim	T	Delay variable
G	Last claim	P\$	Y/N input
K\$	Y/N input		

Table 1. Nag Analysis variables list.

Listing 1 continued

```

410 INPUT"NUMBER OF STARTS ";Y:IF Y=0 TH
EN LET I=0:GOTO 430
420 I=INT(2/Y*.1):D=D+I
430 PRINT"AWARD ";I:FOR T=1 TO 200:NEXT T
440 CLS:PRINT"SCORE: PP# ";E;" IS ";D
450 IF N>0 THEN GOTO 470
460 OPEN"RAM:NAG.DO"FOR OUTPUT AS I
470 PRINT#1,"PP# ";E;" IS ";D:N=N+1:GOTO
60
480 D=D+I:PRINT"AWARD ";I
490 PRINT"SCORE NOW";D: FOR T=1 TO 200:NEXT
T:RETURN
500 PRINT "NO POINTS AWARDED":FOR T=1 TO 20
0:NEXT T:RETURN
510 CLOSE:K$="":CLS:INPUT"DO YOU WANT TO
SEE LIST(Y/N)";K$:IF K$="N" THEN END
520 OPEN"RAM:NAG.DO"FOR INPUT AS I
530 INPUT#1,F,E,G,D
540 PRINT"PP# ";E;" IS ";D
550 IF NOT EOF(1) THEN GOTO 530
560 CLOSE
570 PRINT:PRINT"PRESS ANY KEY TO CONTINU
E"
580 IF INKEY$="" THEN 580
590 INPUT"DO YOU WANT A PRINT OUT(Y/N)";
P$
600 IF P$="Y" GOTO 620
610 IF P$="N" THEN END ELSE GOTO 590
620 OPEN"RAM:NAG.DO"FOR INPUT AS I
630 INPUT#1,F,E,G,D
640 LPRINT"PP# ";E;" IS ";D
650 IF NOT EOF(1) THEN GOTO 630
660 CLOSE:END

```

Harmony and Me

by Ben Firschein

The TRS-80 Model 100's tone generator lets you make music. You can access it easily from Basic with the Sound command. The manual provides a table that matches tone codes with musical notes.

The Model 100 generates notes within a range of five octaves. Unfortunately, there's no software that lets you compose, play back, save, or load a song. To play a song using the tone generator, you must write a program in Basic and use the table in the manual to find the necessary codes. Harmony, Program Listing 2, solves this problem. It runs in 8K RAM.

The program's menu displays the commands. You enter the names of the notes rather than tone codes.

The program plays the note as you press the key, much like a musical instrument would, and it also lets you play the complete song when you're done. You can save the song to load and play it later.

The Main Menu

When you run the program, a menu appears, displaying the amount of free memory and the following options: Make a song, Play back, Save, Load, What are my files, and Quit. Press the appropriate key to select an option. If you don't select an available option, the menu redisplay.

If you don't have enough memory to run the program, the program notifies you and requests that you make more space available and terminates its execution. You can either delete

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Lines	Special Feature (*)	Comments
0-4		Program declaration.
5	*	Model 100 Basic goes to line 200 if there's an error while running the program. (See commentary on lines 200-250 for information on error handling.)
8		Sets maximum number of notes. Change this depending on how much memory your machine has.
10-26		Dimension statements.
30	*	Reads data on notes. The codes (lines 1000-1220) are taken from the table in the manual under the Sound command. The rows are the notes and the columns are the octaves.
32-39	*	Turn the function keys on for use in program.
40-47		Initialize octave, duration, and note number.
50	*	Calls Subroutine that assigns function keys. (See commentary on lines 550-665.)
52-88		Main Menu. Tell you the options, scan keyboard for command (line 75) and go to proper subroutine if the command is valid.
90-99		Compose subroutine.
91		Prints instructions and initializes.
92		Gets a note from the user and identifies it.
93		Tests for command to exit.
94		Plays the note if the note was valid.
95		If entered maximum amount of notes then done.
96		New note.
97		Stores octave, duration, note.
99		Gets another note.
100-160		Subroutine to find a note and identify.
170-180		Subroutine to correct a note.
200-250	*	Error handling subroutine. If there is an error, control is transferred to this part of the program (see line 5).
300-330		Subroutine to print the key labels and initialize the number of notes to zero. It also gives instructions.
400-440	*	Subroutine that lets you see what files you have. This subroutine uses the built-in Basic command called Files, that lists all RAM files.
500-520	*	Subroutine to play a note. L is the octave. K is the variable that is used to print the name of the note and to look up the code for that tone and octave. NS(K) is the name of the note. The SOUND statement calls the tone generator. P%(K,L) is the code for that tone and octave. D is the duration.
550-665	*	Select the octave. Subroutines 610-650 change the octave (L). Subroutines 655-665 change the duration of the tone (D).
700-770		This subroutine (called by line 30) loads the array NS(N) with the names of the notes (A, F, C, etc.) It also loads the matrix P%(N,C) with the codes for the tones. N is the note number, C is the octave. The subroutine loads the codes from the data on lines 1000-1220.
800-885		This subroutine plays back a tune. LV%(NT) is the octave of a given note. DU%(NT) is the duration of a given note. NOS(NT) is the name of the note.
900-960	*	This subroutine saves a tune.
970-996	*	Load a song.
1000-1220	*	Store tone data.

Table 2. Comments on music program structure and features.

some files or change line 8 of the program to free up memory (line 8 specifies the maximum amount of notes allowed). Currently, M (the maximum number of notes) is set at 100; this is about a page of music.

Make a Song

You enter this mode with the M key. The program gives you a summary of the instructions and function key labels. Enter a note using its name (C, A, G notes, etc.) Specify sharps by pressing the shift key and the note key simultaneously (C, A, and G stand for C sharp, A sharp, and G sharp). When you hit the key, the note sounds. Use the Model 100's function keys to change the octave or the duration. Function keys 1-5 control the octave, and function keys 6-8 control the duration of the note. The octave and duration don't change again until you use the function keys to change them. Stop keying in notes at any time by hitting the period key. If you never hit the period key, the program tells you when you key in the maximum number of notes allowed. If this happens, the main menu reappears, and the program retains the notes keyed in so far.

If you key in the wrong notes, you can easily correct them; hit the backspace key to delete notes until you arrive at the first note you want to change. As you hit the backspace key, a cursor shows you the note you're on. Retype the note or notes that you want to correct. The original song is maintained up to

Program Listing 2. Harmony.

```

0 REM music program
1 REM By Ben Firschein
2 REM June, 1983
3 REM for use on Radio Shack TRS-80
  model 100 portable computer
4 REM
5 ON ERROR GOTO 200:REM handle error
8 M=100:REM maximum number of notes
10 DIM NS(12):REM notes
20 DIM P%(12,5):REM pitch
22 DIM LV%(M):REM octave
24 DIM DU%(M):REM duration
26 DIM NOS(M):REM note
30 GOSUB 700:REM read data
32 KEY (1) ON:REM turn on func key
33 KEY (2) ON
34 KEY (3) ON
35 KEY (4) ON
36 KEY (5) ON
37 KEY (6) ON
38 KEY (7) ON
39 KEY (8) ON
40 L=1:REM level (octave)
45 D=12:REM duration of tone
47 C=0:REM note #
50 GOSUB 550:REM assign function keys
52 GOTO 60:REM no time delay
55 REM main program
57 FOR ZZ=1 TO 500:NEXT ZZ:REM delay
60 CLS
61 PRINT"menu          ";FRE(0);"bytes
  free"
62 PRINT
64 PRINT"[m]ake a song","[p]layback"
65 PRINT"[s]ave","[w]hat are my files?"
66 PRINT"[l]oad"
67 PRINT"[q]uit          hit key in [ ] to
  choose"
```

Listing 2 continued

Listing 2 continued

```

75 K$=INKEY$
77 IF K$="" THEN 75
80 IF K$="m" THEN GOSUB 90
82 IF K$="p" THEN GOSUB 800
84 IF K$="s" THEN GOSUB 900
85 IF K$="l" THEN GOSUB 970
86 IF K$="q" THEN END
87 IF K$="w" THEN GOSUB 400
88 GOTO 57:REM another command
90 REM compose
91 GOSUB 300:REM print labels and init
92 GOSUB 100:REM get a note & identify
93 IF K$="." THEN RETURN
94 GOSUB 500:REM play note
95 IF C=M THEN PRINT:PRINT"can only
store";M;"notes.":RETURN
96 C=C+1:REM new note
97 LV%(C)=L:DU%(C)=D:NO$(C)=K$
98 REM 97 stores octave,duration,note
99 GOTO 92:REM another note
100 REM get a note and identify
105 PRINT"o";CHR$(8);:REM cursor and
backspace
110 K$=INKEY$
115 IF K$="." THEN PRINT".":RETURN
120 IF K$="" THEN 110
125 IF ASC(K$)=8 THEN GOSUB 170:GOTO
100:REM back space and get note
130 FOR K=1 TO 12:REM note
140 IF K$=N$(K) THEN 160
150 NEXT K
155 GOTO 110:REM illegal note
160 RETURN:REM was the kth note
170 REM correct a note
172 IF C=0 THEN RETURN:REM no notes.
cannot backspace
173 PRINT " ";CHR$(8);
174 PRINT CHR$(8);CHR$(8);CHR$(8);CHR$(8)
);
176 REM chr$(8) is backspace
178 C=C-1
180 RETURN
200 REM error handling
210 IF ERR=7 THEN PRINT"out of
memory.please make some space":END
220 IF ERR=52 THEN PRINT"file not

```

Listing 2 continued

the note before the cursor. Thus, if you backspace to correct some notes and then type '.' to exit to the main menu, any notes after the cursor are not saved; you must retype any notes that appear after the cursor if you wish to save them.

Play Back a Song

To get into this mode, hit the P key. Enter the play back mode to play back a song you composed. As the song plays, the program displays the octaves and names of the notes.

Save a Song

To save a song type S. The save option writes the song to a file (RAM or cassette). If you type only the file name and don't specify the type of file, the Model 100 assumes it's a RAM file. Since the Model 100 retains its memory even when turned off, files written to RAM remain until you delete them from Basic.

If you enter an illegal file name, the program informs you (in English, not by an error code) and returns you to the main menu. It also alerts you if you attempt to save a RAM file and run out of memory.

Load a Song

You can load songs that you've previously saved. If you type the name of a RAM file that doesn't exist, or a bad file name, the program informs you of the error and returns you to the main menu. After it finds the file, the program loads it and returns to the main menu. You can then play back the song using the play back option.

What Are My Files

To see what files you have in RAM, press the W key. This is an important feature; if you have just composed a song and you have forgotten the names of your files, it's desirable to find out what files you have to prevent writing over a file. This feature also lets you verify whether you've stored a RAM file properly.

Quit

When you finish, leave the program by calling the Quit option (Q). ■

Write to Ben Firschein at 29 Stowe Lane, Menlo Park, CA 94025.

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Listing 2 continued

```

found.":RESUME 55:REM menu
230 IF ERR=55 THEN PRINT"bad file
name.":RESUME 55:REM menu
240 PRINT "error code ";ERR;"in line
";ERL:STOP
250 REM end of error handling
255 REM
300 REM print key lables & initialize
302 C=0:REM no note yet
304 CLS:PRINT"make a song (up
to";M;"notes)"
305 PRINT"hit key of the note to
play.for sharps:"
306 PRINT"shift & the key.'.'=done.hit [
bksp] to"
310 PRINT"change note.fl-f8 change
octave&length:"
312 PRINT
315 PRINT"oct1 oct2 oct3 oct4 oct5 1/4
1/2 1/1"
330 RETURN
336 PRINT"wait";
400 REM what are my files
410 CLS
430 FILES
431 PRINT
434 PRINT"hit space bar to continue ";
435 W$=INKEY$:IF W$<>" " THEN 435
436 PRINT " wait";
440 RETURN
442 REM
500 REM play the note
510 PRINT L;N$(K);' ';
515 SOUND P$(K,L),D
520 RETURN
550 REM select the octave
600 ON KEY GOSUB
610,620,630,640,650,655,660,665
605 RETURN
610 L=1:RETURN
620 L=2:RETURN
630 L=3:RETURN
640 L=4:RETURN
650 L=5:RETURN
655 D=12:RETURN:REM tone duration
660 D=25:RETURN
665 D=50:RETURN
700 REM load arrays with values
705 REM
710 FOR N=1 TO 12:REM note
720 READ N$(N):REM note name
730 FOR C=1 TO 5:REM octave
740 READ P$(N,C):REM note,octave
750 NEXT C
760 NEXT N
770 RETURN
800 REM playback
801 CLS:PRINT"playback":PRINT
802 IF C>0 THEN 820
804 PRINT"error. no notes to play"
808 RETURN
820 FOR NT=1 TO C:REM stored notes
830 L=LV$(NT):REM octave
845 D=DV$(NT):REM duration
850 K$=NO$(NT):REM note
860 GOSUB 130:REM identify
865 GOSUB 500:REM play the note
870 NEXT NT

```

Listing 2 continued

Listing 2 continued

```

875 PRINT
885 RETURN
900 REM save
905 CLS:PRINT"save":PRINT
906 IF C>0 THEN 910
908 PRINT"error. no notes to save"
909 RETURN:REM to menu
910 INPUT"filename ";N$
920 OPEN N$ FOR OUTPUT AS 1
923 PRINT"saving ";N$
925 FOR NT=1 TO C
930 PRINT #1,LV$(NT),DU$(NT),NO$(NT)
932 PRINT LV$(NT);NO$(NT);" ";
940 NEXT NT
942 PRINT #1,0,0,"*":REM eof
944 CLOSE 1
955 PRINT:PRINT"saved. ";FRE(0);" bytes
free."
960 RETURN
970 REM load
972 CLS:PRINT"load":PRINT
974 INPUT"file ";NA$
976 OPEN NA$ FOR INPUT AS 1
978 PRINT"found ";NA$
980 FOR C=1 TO M:REM m=max
982 INPUT #1,LV$(C),DU$(C),NO$(C)
984 IF NO$(C)="*" THEN 990:REM done
986 NEXT C
990 C=C-1
992 CLOSE 1
994 PRINT"loaded"
996 RETURN
1000 DATA "g",12538,6269,3134,1567,783
1020 DATA "G",11836,5918,2959,1479,739
1030 DATA "a",11172,5586,2793,1396,698
1040 DATA "A",10544,5272,2636,1318,659
1050 DATA "b",9952,4976,2484,1244,622
1060 DATA "c",9394,4697,2348,1174,587
1070 DATA "C",8866,4433,2216,1108,554
1080 DATA "d",8368,4184,2092,1046,523
1090 DATA "D",7900,3728,1975,987,493
1200 DATA "e",7456,3718,1864,932,466
1210 DATA "f",7032,3516,1758,879,439
1220 DATA "F",6642,3321,1660,830,415

```

Remote Robot

by Peter W. Deininger and Rolf A. Deininger

Radio Shack sells a radio-controlled robot (part number 60-3023A) that you can control with your Model 100. It's a cute, but simple, robot that's only able to move forward, backward, and make turns.

If you open the robot's hand-held remote control, you'll find that pressing the button causes a contact (two copper plates) to close.

The Model 100 controls the robot easily with two resident Basic commands, Motor On and Motor Off. Normally, these commands control a cassette recorder connected to the 100. They turn a relay on the Model 100 on or off. The smallest plug on the cassette interface cable carries the relay status to the recorder.

To control the robot through the Model 100, all you need do is install a subminiature phone jack (Radio Shack part number 274-292) in the robot's remote control with the two

```

10 'MODEL 100 ROBOT CONTROL'
20 'PETER DEININGER JULY 83'
30 PRINT"HOW MANY SECONDS FOR FULL TURN"
40 INPUT F
50 FS=320*F:RT=1/4*FS
60 RVS=1/2*FS:LFT=3/4*FS
70 CLS:PRINT" TURN ON ROBOT....."
80 A$=INKEY$:IF A$=""THEN 80:'GET CMND'
90 A=ASC(A$):A=A-27
100 IF A>5 OR A<1 THEN 80
110 ON A GOSUB 130,160,190,210,240
120 GOTO 80
130 PRINT"RIGHT ";
140 MOTOR ON:FOR I=1 TO RT:NEXT I
150 MOTOR OFF:RETURN
160 PRINT"LEFT ";
170 MOTOR ON:FOR I=1 TO LFT:NEXT I
180 MOTOR OFF:RETURN
190 PRINT"FORWARD ";
200 MOTOR OFF:RETURN
210 PRINT"REVERSE ";
220 MOTOR ON:FOR I=1 TO RVS:NEXT I
230 MOTOR OFF:RETURN
240 PRINT"STOP ";
250 FOR I=1 TO 40
260 MOTOR ON:FOR D=1 TO 60:NEXT D
270 MOTOR OFF:FOR D=1 TO 60:NEXT D
280 NEXT I:RETURN

```

Program Listing 3. Robot Control.

leads connected to the push-button switch. By plugging the cassette cable into this socket, you can simulate pushing the button on the remote controller with your Model 100.

The Motor On command is now equivalent to pushing the button; the Motor Off command is equivalent to releasing the button.

Robot Control

The following program lets you control the robot from the Model 100 keyboard after you plug in the cassette cable.

```

10 A$=INKEY$:IF A$=""GOTO 10
20 IF A$="F" THEN MOTOR OFF
30 IF A$="R" THEN MOTOR ON
40 GOTO 10

```

Typing an F makes the robot go forward and typing an R makes it go backward.

To make the robot go left and right and stop takes a bit more work (see Program Listing 3). Making a left turn is analogous to trying to turn left on a road that prohibits left turns. By making three right turns, you ultimately head off in the left direction. The same holds true for the robot; the program triggers three right turns to make the robot turn left. It simulates a stop by repeatedly sending commands to move the robot forward and backward in small steps.

The general control program begins by asking how long, in seconds, it takes the robot to make a full, 360-degree turn. The program then uses this estimate to turn the robot 90, 180, and 270 degrees. Use the four arrow keys to move the robot in the appropriate direction and press the space bar to make the robot stop. The program runs in 8K RAM. ■

Write to Peter and Rolf Deininger at 3063 Overridge Drive, Ann Arbor, MI 48104.

Winning Numbers

by Ronald F. Balonis

If you play a daily numbers game, this program increases your chances for that megabucks win. It helps you choose which daily number to bet on no matter what number selection scheme you prefer.

The Daily Numbers Statistician computes a ranked histogram analysis of the digits used in a daily numbers game (see Program Listing 4). The program ranks digits according to the frequency with which they're drawn.

The program analyzes the numbers drawn from a daily numbers file (DAILY.DO), which you maintain using the resident text editor. Using this information, you can compute the mathematical probability of success for numbers based on the frequency distribution.

Program Operation

The daily numbers file is organized as an inverted file with the latest entries listed first (see Fig. 1). The file data given here is from the Pennsylvania Daily Number Lottery from April 29, 1982, to April 29, 1983. Change the state by changing the definition of STATE\$ in line 10 and inserting an historical file of the appropriate daily numbers.

Program operation is screen-oriented. Screen 1 asks you if you want to recalculate the statistics (you have to do this for the first run of the program to create the statistics file DNSTAT.DO). Screen 2 prompts you for the number of digits (greater than 10) you select for the recalculate option. Screens

3 and 4 notify you of program operation.

Screen 5 displays the analysis. The ranked histogram display shows the random nature of each digit and digit trends in a run of numbers. Enter a number to calculate its probability and press the E key to exit to Screen 1.

Daily Number Statistician requires between 4K and 6K of memory. The program DAILY.N.BA takes up 3.75K with remark statements, 3K without. The statistics file (DNSTAT.DO) uses 360 bytes of memory. The daily numbers file, DAILY.DO, needs 4 bytes of memory for each three-digit number you enter.

To use the program on an 8K machine, key it in without the remark statements. The program's only limitation is the amount of memory you have available. ■

Contact Ronald F. Balonis at 118 Rice St., Trucksville, PA 18708.

Program Listing 4. DAILY.N.BA.

```

5 'DAILY.N.BA 5/30/83 BY RON BALONIS
10 CLEAR 200:STATE$="PA"
15 TITLE$="* "+STATE$+" DAILY NUMBER
  STATISTICIAN *"
20 CLS:PRINT@4,TITLE$
30 PRINT@130,"RECOMPUTE STATISTICS?"
35 PRINT@209,"<Y>ES, <N>O OR <E>XIT ";
40 POS=233:LG=0:GOSUB 10000:'SCAN KEYS
50 IF KB$="Y" THEN 100
60 IF KB$="N" THEN 800
70 IF KB$="E" THEN MENU ELSE GOTO 20
80 '
90 '---READ THE DAILY NUMBER FILE---
100 CLS:PRINT@4,TITLE$
105 PRINT@125,"NUMBER OF NUMBERS ";:
  INPUT N0
110 IF N0<10 OR N0>999 THEN 100
115 PRINT@125,"**** COMPUTING STATISTICS
  ****"
120 '---READ & SELECT SORT #S OF # FILE---
125 OPEN "DAILY0.DO" FOR INPUT AS 1
130 NX=NX+1
135 FOR I=1 TO 4
140 IF EOF(1) THEN 160
145 N$=INPUT$(1,1):N=VAL(N$):STAT(I,N)
  =STAT(I,N)+1
150 NEXT I
155 IF N0=NX THEN 160 ELSE 130
160 CLOSE 1
180 '
190 '---FORM RANKING INDEX---
200 FOR I=1 TO 4
210 FOR II=1 TO 10
220 RANK(I,II)=II-1
230 NEXT II
240 NEXT I
480 '
490 '---RANK FOR LEFT TO RIGHT DISPLAY---
500 FOR II=1 TO 3:M=10:N=10
510 M=INT(M/2)
520 IF M=0 THEN 590 ELSE I=1:L=N-M
530 J=I
540 K=J+M:JJ=RANK(II,J):KK=RANK(II,K)
550 IF STAT(II,JJ)>=STAT(II,KK) THEN
580

```

Listing 4 continued

```

157 803 542 833 380 600 823 262 954 414
120 668 501 516 475 119 447 952 149 322
847 485 936 790 236 051 904 120 387 031
641 008 107 552 061 302 830 775 877 306
917 172 580 082 518 603 030 981 583 932
242 013 707 643 438 828 155 572 617 272
751 538 530 777 510 351 469 587 267 790
579 908 428 514 366 991 931 602 837 917
324 291 580 587 437 217 912 306 088 271
513 990 367 271 665 174 034 815 431 724
651 126 936 253 147 560 255 483 619 530
455 787 433 568 007 185 755 829 695 479
075 443 000 551 555 967 160 925 721 277
108 694 151 151 135 430 594 037 569 847
808 515 653 737 861 986 662 621 711 798
995 368 041 540 221 347 952 446 625 735
811 726 594 079 317 357 574 852 023 039
174 842 954 298 706 440 402 308 097 851
520 885 663 700 877 989 215 398 031 481
060 802 289 744 258 961 805 144 064 601
605 731 995 722 645 590 511 243 308 470
329 216 310 302 130 321 668 707 955 468
773 520 096 663 004 688 817 366 444 695
068 577 594 473 218 243 528 180 492 385
186 498 098 195 151 929 806 042 947 690
715 398 235 069 970 006 735 612 336 140
934 485 374 021 028 055 695 696 623 858
522 308 545 590 915 321 522 066 998 600
045 267 356 013 289 477 662 290 524 277
399 855 164 611 882 690 144 517 771 673
329 325 782 678 003 700 230 874 424 189
673 444 649 696

```

Figure 1. Daily numbers file. The latest entries are listed first.

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Listing 4 continued

```

560 R=RANK(II,J):RANK(II,J)=RANK(
II,K):RANK(II,K)=R
570 J=J-M:IF J<1 THEN 580 ELSE 540
580 I=I+1:IF I>L THEN 510 ELSE 530
590 NEXT II
680 '
690 '---SAVE THE STATISTICS IN A FILE---

700 OPEN "DNSTAT.DO" FOR OUTPUT AS 1
705 FOR II=0 TO 9
710 PRINT#1,USING" # ";II;
715 NEXT II
720 PRINT#1,""
725 FOR I=1 TO 4
730 FOR II=0 TO 9
735 PRINT#1,USING"### ";STAT(I,II);
740 NEXT II
745 NEXT I
750 FOR I=1 TO 4
755 FOR II=1 TO 10:
760 PRINT#1,USING"### ";RANK(I,II);:
765 NEXT II
770 NEXT I:CLOSE 1:GOTO 1000
780 '
790 '---READ STATISTICS FILE---
800 CLS:PRINT#4,TITLE$
805 PRINT#126,"***** READING STATISTICS *
***"
810 OPEN "DNSTAT.DO" FOR INPUT AS 1
815 INPUT#1,U0$
820 FOR I=1 TO 4
825 FOR II=0 TO 9
830 INPUT#1,STAT(I,II)
835 NEXT II
840 NEXT I
845 FOR I=1 TO 4
850 FOR II=1 TO 10
855 INPUT#1,RANK(I,II)
860 NEXT II
865 NEXT I
870 CLOSE 1:NX=STAT(4,0)
980 '
990 '---THE HISTOGRAPHIC ANALYSIS---
1000 CLS:PRINT STATE$+" DAILY"
1010 PRINT" NUMBER "
1020 PRINTUSING"LAST ###";NX;
1025 PRINT"# "
1030 PRINT"WIN PROB."
1035 PRINT:PRINT"[<E>XIT]"
1040 PRINT#240,"[ENTER #]"
1050 PRINT#283,"000";
1055 '---COMPUTE DISPLAY OFFSET---
1060 FOR I=1 TO 3
1070 IF STAT(I,RANK(I,1))-XSET>53 THEN
XSET=XSET+1:GOTO 1070
1080 NEXT I
1090 '---RANKED HISTOGRAPH DISPLAY---
1100 II=0
1110 PSET(53,54)
1120 FOR Y=1 TO 180 STEP 60
1125 II=II+1
1130 LINE(52+Y,0)-(112+Y,53),1,B
1140 PSET(112+Y,54)
1150 FOR I=0 TO 9
1160 Y0=Y+54+I*6
1170 X0=53-STAT(II,RANK(II,I+1))+XSET
1175 IF X0>53 THEN X0=53
1180 LINE(Y0,X0)-(Y0+2,53),1,BF

```

Listing 4 continued

Listing 4 continued

```

1190 PRINT@289+I+Y/6,RIGHT$(STR$(RANK
(II,I+1)),1);
1200 NEXT I
1210 NEXT Y:GOTO 1400:'DISP PROB OF 000
1280 '
1290 '--COMPUTE A #'S PROBABILITY--
1300 P0S=283:LG=3:GOSUB 10000:'SCAN KEYS

1390 '--PROB. OF 3 INDEPENDENT EVENTS--
1395 '--BASED ON NUMBERS DRAWN IN PAST-
1400 PROB=(STAT(1,N1)/STAT(4,0))
1410 PROB=PROB*(STAT(2,N2)/STAT(4,0))
1420 PROB=PROB*(STAT(3,N3)/STAT(4,0))
1430 '
1440 PRINT@160,USING" #.#####";PROB;
1450 GOTO 1300:'LOOP ON PROB. COMPUTE
1500 '
9990 '---KEY BOARD---
10000 K1=255:DISP=65024
10100 STRT=P0S:IK=STRT:EN=P0S+LG
10110 K2=PEEK(IK+DISP)
10115 PRINT@IK,CHR$(K1);:IC=0
10120 KB$="":KB$=INKEY$:IC=IC+1
10125 IF IC=20 THEN PRINT@IK,CHR$(K2);:
ELSE IF IC=40 THEN 10115
10135 IF KB$="" THEN 10120
10140 KB=ASC(KB$):PRINT@IK,CHR$(K2);

```

```

10145 IF KB=28 THEN 10220:'CURSOR RIGHT
10150 IF KB=29 OR KB=8 THEN 10240:'BCKSP
10155 '--GET ONE CHARACTER & RETURN--
10160 IF LG=0 THEN PRINT@IK,KB$;:RETURN
10165 IF KB$="E" THEN RUN:'EXIT BY ABORT

10170 IF KB=13 THEN 10300:'NORMAL EXIT

10175 IF KB<48 OR KB>57 THEN 10110
10180 IF IK=EN THEN 10110
10185 PRINT@IK,KB$;:'--ONLY NUMBERS--
10190 '
10195 '--ADJUST CURSOR POSITON--
10200 IF IK+1>EN THEN 10110 ELSE IK=IK+
1:GOTO 10110
10210 '--CURSOR RIGHT ONE SPACE--
10220 IF IK+1>EN THEN 10110 ELSE POKEIK+
DISP,K2:IK=IK+1:GOTO 10110
10230 '--BACKSPACE CURSOR--
10240 IF IK-1<ST THEN 10110 ELSE POKEIK+
DISP,K2:IK=IK-1:GOTO 10110
10280 '
10290 '--SET UP VALUES & RETURN--
10300 I=STRT+DISP:N1=VAL(CHR$(PEEK(I)))
10310 I=I+1: N2=VAL(CHR$(PEEK(I)))
10320 I=I+1: N3=VAL(CHR$(PEEK(I)))
10330 '--WAIT FOR KEY UP--
10340 IF INKEY$="" THEN RETURN ELSE
10400

```

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RAM FILES

*RAM Files is our readers' forum for the C*Notes section. Send your questions and comments to: C*Notes Editor, 80 Micro, 80 Pine St., Peterborough, NH 03458.*

Itinerary 100 Error

Brad Dixon's "Itinerary 100" program (July 1983, p. 173) has a bug that precludes programs from correctly reading data files.

Lines 170-180 all contain the same logic fault; they check for an end-of-file, but don't read the file if EOF is not encountered. Adding an Else statement to these lines allows the program to read all of the data. The corrected lines are in Program Listing 1.

Jim Gaffney
10549 Springwood Drive
El Paso, TX 79925

```
170 FOR I=1 TO NH: IF EOF(1) THEN 171 EL
SE INPUT#1,AD(I),HO(I),DR(I),DD(I): NEXT
171 FOR I=1 TO NO: IF EOF(1) THEN 172 EL
SE INPUT#1,OT(I): NEXT
172 FOR I=1 TO NA: IF EOR(1) THEN 180 EL
SE INPUT#1,WH(I),DA(I),DT(I),DO(I): NEXT
180 FOR I=1 TO NC: IF EOF(1) THEN 190 EL
SE INPUT#1,RS(I),AG(I),PD(I),PL(I),RD(I),
RE(I): NEXT: CLOSE: GOTO 100
```

Program Listing 1. Correction for "Itinerary 100" program.

Of Protocol and Handshaking

"Nothing's Perfect" by Ken Barbier (August 1983, p. 209) is correctly named. Barbier says that the Model 100's serial port doesn't conform to the RS-232 standard, and then he goes on to say that the 100 ignores RTS and CTS handshaking!

Since when does protocol become part of the RS-232 standard? How the port handles RTS and CTS is a function of the software driver.

I have both a Model I and a Model III with RS-232 ports. I write communication drivers and use the CTS and RTS as I choose in software. The hardware provides the information, but it is up to me to use it.

The fact that the 100 protocol doesn't match Barbier's printer is not the fault of the RS-232 port, but of the incompatible drivers.

I don't use CTS or RTS at all; I use XON/XOFF. When I'm on CompuServe, RTS and CTS are of little value because my modem has no way to send the information on the tones, but CompuServe does respond to XON/XOFF.

I have communicated at the 19,200 baud rate (hard wired) and the handshaking works well. My effective baud rate is slowed by the screen scrolling as mentioned, but I don't lose data.

RTS and CTS are useful in the multiwire and hardware

environment, but when it comes to modem communications, the XON/XOFF protocol provided is better.

If Barbier wants to point to the RS-232 standard, he should point out that the standard defines the 1 and zero states as "greater than +3 and -3 volts." If you check the voltage swing you will find that it's marginal.

Radio Shack has a modification to change the value of some resistors, so if you have an early unit you might wish to have it checked for this free modification.

C. Warren Andreasen
P.O. Box 8306
Van Nuys, CA 91409

Barbier's Reply

C. Warren Andreasen's letter contains a lot of information valuable to any Model 100 owner; however, I think he missed the point I was trying to make about the 100's RS-232 handshaking signals.

Since the Radio Shack manual includes a list of interface signals, and since the four signals named in my article are on the list, the computer is defective in design or software if it does not use those signals.

The distinction between standard and protocol is not important. Radio Shack says the signals are used, but they aren't: that is what's hurting the users.

The Model 100 is not alone in improperly using these handshaking lines, and as Andreasen's letter points out, the XON/XOFF protocol is more reliable when implemented.

But what is the user to do when connecting to a device that does not include XON/XOFF? He will look in the manual and be misled into believing that the standard RS-232 handshake signals are implemented and are used in a standard manner.

They aren't, and that is the point I was trying to make.

Ken Barbier
Box 1253
Borrego Springs, CA 92004

Nothing's Perfect Revisited

Concerning Ken Barbier's article, "Nothing's Perfect" (August 1983, p. 209), I, too, find the Model 100 to be very slow on a benchmark program involving trigonometric functions.

On the other hand, I find the 100 to be quite fast in calculations involving variables assignment, floating point arithmetic, and so on.

It's 35 percent faster than the standard Model III for these types of calculations with single-precision accuracy on each machine. With double-precision calculations, the difference is even greater.

Regarding the RS-232 port, the standard Radio Shack Model III serial cable (PN 260-1408) fits the Model 100 perfectly. Therefore, I disagree with the concern that a standard cable does not fit.

Barbier had trouble uploading text from the 100 to Word-

Star because of the 100's hard carriage return at the end of each line.

Appendix C of the 100's manual (p. 198) says that to send a text file as is, without carriage returns, press the enter key without specifying a number in response to the Width query when uploading a file from TELCOM.

This procedure works fine for me in uploading text files from the 100 to Scripsit and Superscript.

*James M. Stubchaer
869 North Kellogg Ave.
Santa Barbara, CA 93111*

100 Screen Dump

Soon after I purchased my Model 100 I wrote to Tandy to ask for information about getting screen dumps showing pixel graphics. They have not been very helpful in releasing such information.

Does anyone have a program that will duplicate the Model 100 screen on a printer?

*William R. Harlow
340 Halidonhill Drive
Cincinnati, OH 45238*

Runner's Program

Program Listing 2 may interest your readers who, like myself, are both computer enthusiasts and runners.

Many runners log their daily runs to keep track of distance run and time required. To determine their velocity, they convert their running time into units of minutes per mile.

To use this program, input the distance run and the time elapsed (in minutes and seconds). The program then calculates the rate at which you ran.

*H. Robert Lind
26 Ferris Hill Road
New Canaan, CT 06840*

```
10 CLS
20 INPUT "HOW MANY MILES DID YOU RUN TODA
Y?";D
30 CLS
40 INPUT "WHAT WAS YOUR TIME IN MINUTES?"
;M
50 CLS
60 INPUT "AND IN SECONDS?";S
70 CLS
80 P=(S/60+M)/D
90 PRINT INT(P)
100 T=((S/60+M/D-INT(P))*60
110 PRINT INT(T)
120 PRINT "YOU RAN "D" MILES AT "INT(P)"
MIN. AND "INT(T)" SEC."
```

Program Listing 2. Runner's program.

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Faster Foxfighter

Thanks for the articles on the Model 100. I bought a 24K version to supplement my Model III and use both primarily for civil engineering calculations and word processing.

Just for fun, I keyed in the "Foxfighter" game program from the August 1983 issue (p. 200) and made some minor changes to save memory and make it run faster.

Here are the changes:

```
5 DEFINT A-Z
20 CS=CHR$(239):DS=CHR$(238):ES=CHR$(232):FS=CHR$(237):
GS=CHR$(233):HS=STRING$(9,239)
```

The first line change declares all numeric variables to be integers (line 5). This change alone gives a noticeable increase in the speed of the fighter.

The other changes reduce the volume of typing to enter the program, and save 600 bytes of memory. The original program includes about a hundred PRINTCHR\$(xxx) statements.

I assign the CHR\$(xxx) statement to string variables (revised line 20). The syntax is CS=CHR\$(xxx). Thereafter, two characters replace nine for every occurrence.

Lines 290-320 of the original program print CHR\$(239) nine times. This can be shortened by using the Model 100's STRING\$ function (line 20). The form is HS=STRING\$(9,239). This creates a string of nine CHR\$(239)s.

I omitted instructions from my version of the program. The result of all these changes is an 1,843-byte program instead of the original version's 3K.

*James M. Stubchaer
869 North Kellogg Ave.
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March 1983

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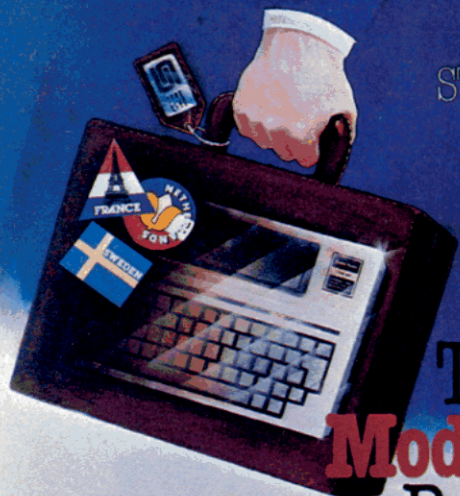
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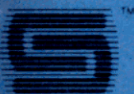
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- 3-6 The Interface Group, Needham, MA. **Denver Computer Showcase Expo** Currigan Hall, Denver, CO.
- 5-7 San Diego Computer Society, San Diego, CA. **San Diego Computer Fair** Scottish Rite Center, San Diego, CA.
- 7-9 IEEE Computer Society, Silver Spring, MD. **24th Annual Symposium on Foundations of Computer Science** Tucson Marriott, Tucson, AZ.
- 10-13 The Interface Group, Needham, MA. **Los Angeles Computer Showcase Expo** Convention Center, Los Angeles, CA.
- 17-19 Northeast Expositions Inc., Chestnut Hill, MA. **Northeast Computer Show and Software Exposition** Hynes Auditorium, Boston, MA.
- 17-20 The Interface Group, Needham, MA. **Chicago Computer Showcase Expo** McCormick Place, Chicago, IL.
- 18-19 Oklahoma State University, Stillwater, OK. **Microcomputers in Education Conference** OSU campus.

28-12/2 The Interface Group, Needham, MA. **Comdex/Fall '83** Convention Center, Las Vegas, NV.

December

- 6-8 IEEE Computer Society, Silver Spring, MD. **Software Maintenance Workshop** Naval Postgraduate School, Monterey, CA.
- 7-9 IEEE Computer Society, Silver Spring, MD. **Real-Time System Symposium** Crystal City Marriott, Arlington, VA.
- 8-11 Computer Expositions Inc., Annapolis, MD. **Southeast Computer Show & Office Equipment Exposition** Atlanta, GA.
- 12-14 IEEE Computer Society, Silver Spring, MD. **Computer Networking Symposium** Sheraton Inn, Silver Spring, MD.

January

- 31-2/3 CW Conference Management Group, Framingham, MA. **Communication Networks Conference and Exposition** Convention Center, Washington, DC.

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will master efficient use of the stack.

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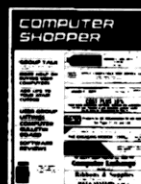
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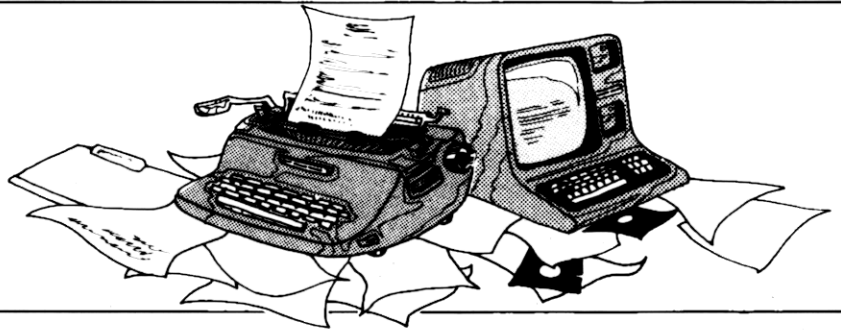
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NEWS THIS MONTH



Talking with Tandy

New merchandising execs and hints of MS-DOS.

With other microcomputer makers reporting financial losses, laid-off workers, and wholesale resignations and replacements among executives (see following story), Radio Shack has gone the other way. Instead of one director of computer merchandising, Fort Worth now has three—and, according to the two product sales chiefs, aggressive plans to stay competitive in the fast-changing hardware and software market.

Until August 1, Radio Shack relied on Jon Shirley, vice-president of computer merchandising, and Ed Juge, director of the department. With Shirley's move to Bellevue, WA, and the presidency of Microsoft Corp., Tandy chose a tripartite arrangement. Bill Wash former customer services manager, became director of computer merchandising services—keeping his old responsibilities, and accepting the leadership of Radio Shack's software support group and third-party software program.

Mark Yamagata, a 15-year Tandy man who's spent the last three as merchandising director for retail operations in England, moved back to Texas as director of merchandising for personal computer products. Yamagata will concentrate on the Models I/III/4, the Model 100 portable, and the Color and Pocket Computers.

As for Juge, he'll handle the remaining items—the Models II/12/16 and peripherals—as director of merchandising for business computer products. Juge will also head the software products planning group.

President John Roach was quick to scotch any comparison between the Tandy troika and some struggling competitors' executive realignments: "Oh,

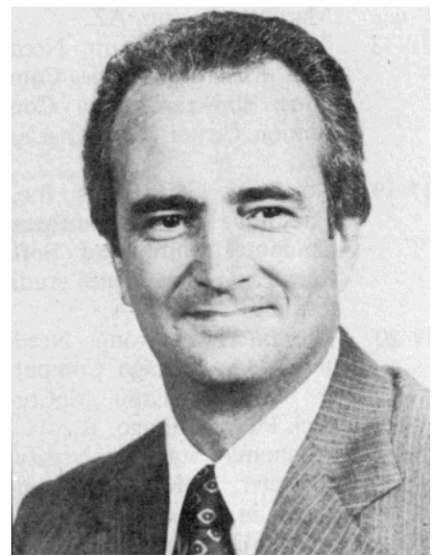


Roach: Separating consumer and business micros. (Radio Shack photo.)

not at all. Not at all. Jon Shirley had an excellent opportunity, one he couldn't turn down and one we really couldn't encourage him not to accept, and it gave three of our long-time and seasoned people an opportunity to take on his responsibilities.

"Certainly that function [merchandising] has grown substantially over the last four or five years, and since we did have the opportunity to really review it in detail, we felt that the best way to organize it—to give proper emphasis and scope to each job—was to separate the essentially consumer- from the primarily business-oriented side, although you understand there's a little gray area between product lines."

Agreed Juge, "The regrouping was



Juge: "We have no intention of giving our profit away." (Radio Shack photo.)

merely a matter that, with Jon Shirley's leaving, gave us the opportunity to do some things we'd had the idea of doing for some time.

"When I came aboard five years ago," Juge recalled, "the merchandising department consisted of me and a secretary, and the programming group was two or three guys and their secretary. It's grown to such a huge thing now that we really need to spread out the management. This will give everybody a chance to concentrate a little more strongly on their particular areas."

Stressing the three directors' equal status, Roach said he didn't foresee any who's-in-charge conflicts: "I think that, on the one hand, lines [between the divi-

sions] are pretty clear, and on the other hand, cooperation between [them] where needed is no problem. They coordinate and report directly to [Executive Director for Marketing] Bernie Appel, who's the same person Jon Shirley reported to."

Whatever the chain of command, these are daunting times to start a job in the micro industry. As they take charge of the TRS-80 line, Yamagata and Juge face price-cutting chaos in the market's low end, as well as a formidable threat from the IBM PC at top and powerful new machines in the middle—not to mention a general perception that Radio Shack is losing market share. In separate phone interviews, the pair discussed these challenges, and their plans, with *80 Micro*.

The immediate concern is market share; while Radio Shack sales are up, they're not growing as fast as the rest of the industry. Portia Isaacson, president of Future Computing Inc. of Richardson, TX, predicted in *Computer Retail News* that 1982 versus 1983 figures would show Tandy falling from 14.5 to 11.8 percent of the under-\$10,000 computer market. Apple, Isaacson said, would maintain its share but slip from first to second place, while IBM, vaulting from 14.2 to 19.5 percent of total sales, would take the overall lead.

Both Radio Shack directors, however, expressed satisfaction with sales. "We've looked at some sales numbers and I've been very pleased with the numbers we've seen in the last few months [for the Models 4, 12, and 100]," Yamagata said. "They're all doing quite well."

On the other hand, the man in the street doesn't think in terms of sales or profit figures. Some critics claim that Tandy has lost the household-name status it enjoyed some years ago, as massive advertising and distribution have spread the TI, Atari, and Commodore gospel. Has the average buyer been trained to equate "personal computer" with Apple, IBM, and Commodore, going to department stores instead of Radio Shack to shop?

"I don't think so," Yamagata answered. "Our products, such as the Model 100, have really made a big impact into the market. I don't feel we've lost that much in the marketplace."

"I don't think we're slipping," Juge concurred. "Of course, when you get into the Atari and Commodore thing, you're into a whole different ballgame, because those are being sold through

the discount houses and K-Marts and Toys R Us and places like that.

"Even though we have 6,500 stores in the U.S., that doesn't make quite as much noise as 20,000 of those stores. So the visibility level is certainly different," Juge continued. "And there're a lot more players in the market today. I think everybody's overlooking that four years ago there were just three of us in the market and now there are how many?"

Tandy may keep a lower profile than other firms, and the VIC-20 may outsell the Color Computer, but Juge cited some companies' heavy losses as a reason to decisively reject TI- or Commodore-style pricing tactics. "TI is fighting for that very low-end market with Atari and a number of other folks, and we're more than content to pick off whatever percentage of that market we've got. If there's 10 percent of the market that's profitable for us, we'll take it.

"I don't think anybody really knows market share figures," Juge claimed. "Who knows? I've seen different figures from different people, and most of them are claiming that we're down, maybe number seven or number eight, in the very low end of the market—but when the top three are selling below cost, I don't want to be in the top three. In the middle bracket, we're at least number two or number three.

"We have no intention of giving our profit away. If we're not going to do something profitable in a market, we'll get out of it. Believe it."

Yamagata agreed, saying, "Fortunately, our products are sold in our stores only and don't have to fight for shelf space and compete in price wars. Obviously, we have to be aware of what is happening in the market, and we have to stay within the price point. We don't have to go down and slug it out with everybody, though we have to stay competitive."

At this writing, Tandy has nothing that's directly competitive with this fall's new middle-range machines—micros such as Coleco's Adam and IBM's Peanut, which promise full desktop power at sub-\$1,000 prices. Juge admitted that Fort Worth is waiting to see the Peanut ("I don't think anybody really knows what it's going to be yet"), but neither he nor Yamagata professed to be particularly worried about Adam.

"I think we'd like to see [the Adam]

when it comes out," Yamagata said. "We've heard so much about it and we've read about it, but to produce it and to get people to accept it are two different things. People buy not only for price, but for quality and support, and I think we've proven that we can do that. Coleco is going to have to prove that they can do that.

"Frankly, I think the interest in Adam is going to be good for the whole market," Yamagata concluded. "I mean, [people] won't just rush out and buy it first thing; it's a lot of money. They'll look around, they'll shop."

Juge gave Adam even less credit: "The Adam is probably going to pick up some business that would not otherwise have existed, in my view. I don't believe that a single person who was going to buy a business-quality word processor would even think about an Adam. I see it as a competitor for electric typewriters."

Returning to his mass-versus-class merchandising theme, Juge used a photographic metaphor to summarize Adam's status: "I don't think the serious computer vendors are going to get excited about it. The K-Marts are going to get excited about it, and those guys have been selling Mamiya cameras forever. And Canon continues to sell more AE-1 cameras than any other camera on the market.... There are people who want a little more than they can get from a down-and-dirty discount house."

In competing with mass micro distributors, Radio Shack has traditionally emphasized its full product line and service support. Both Yamagata and Juge said this marketing strategy would remain unchanged—that Tandy plans to do essentially the same thing, but to do it better.

One change, to be more specific, involves software availability. Both directors indicated a commitment from Fort Worth to more and better programs, with the Model 4's CP/M as only the beginning.

"Our distribution is firm and well established," Juge said, "and we plan to bolster it and try to cure the problems that we've obviously had. Nobody's perfect, but we plan to address those and try to get better than we are today.

"[As for software,] I think people can see a little change in us. After all, we've got CP/M available, if Digital ever gets it to us, and of course we're

supporting Xenix." (Pressed for news of the still-delayed CP/M, Juge said, "It looks like it's going to be late October, early November. They're having a little problem getting the bank switching right.")

"And I can tell you that today we're working with more outside software vendors, of the quality that are producing major, major software products—for instance, we're bringing out PFS for the Model 4 and Model III," Juge promised. "There are others in that class of product that I'm not quite at liberty to talk about yet, but we're going to have the software people want, and we're going to spend more time talking with the outside software folks before we announce new products, so we can hit the market when we announce them with some or all of the new software people want."

"I think we'll become more aggressive in producing more software," Yamagata said. "I think we all agree that software sells hardware, and we have to make whatever is required to sell our hardware available on software."

That statement, turned around, might almost be a rationale for Tandy's building a 16-bit machine to run today's popular MS-DOS software. Yamagata kept silent on the subject, but others are talking—some about an 8086 board for the Models 12 and 16, others about a brand-new computer.

In the August 8, 1983, *InfoWorld*, John C. Dvorak wrote, "Radio Shack watchers say that the company will bring out an IBM-compatible desktop within 12 months." Asked for comment, Juge didn't say there wouldn't be an MS-DOS TRS-80, though he did say that Tandy would not go the Compaq/Eagle/Columbia route:

"As far as an IBM product, I can pretty well assure you that we wouldn't come out with just another IBM look-alike. If we came out with something that ran MS-DOS, for instance, it would not be just another PC machine.

"If we did anything like that at some point in the future, I think it would have to be with something in mind other than just picking up some leavings from IBM. That just doesn't make any sense. I just don't see it. . . . I won't say we've not been copycats, because traditionally in our consumer line we've waited to see what's going on, and if something has a market we've gone after it. But we have not just gone on and said, 'Build me one

like that.' We like to have different features, to bring more to the table than what's already there."

As if the prospect of an IBM-compatible Tandy desktop weren't enough, Dvorak and others have predicted that 16-bit CMOS chips, such as Harris Corp.'s new 80C86, will mean a super Model 100 in 1984. Chris Christiansen, an analyst with Boston, MA's Yankee Group, speculated that next summer's new portable will include a 16-line, 80-column screen, 256K RAM, and 128K ROM of windowing, multi-tasking software in a package one-third the current 100's height.

Such detailed prediction meets silence from Fort Worth. Asked about a new Model 100, Yamagata said only, "We are looking. We're very pleased with the sales of the 100, and we're looking at different products to complement it. There could be refinements, or memories could be made larger. We've looked at various avenues to make it better, and we have on our drawing boards ideas to further that."

"Oh, we've got a few things up our sleeves," Juge said. "We're constantly looking at what our next-generation products of everything should be. I don't think we've brought a product out in the last three years that we haven't looked at what its next generation should be even before we've announced it."

"Obviously, we've had great success

with the Model 100, so we're looking at what the next product should be. I don't know when it should be out. I don't think you'll see it this year; I don't think you'll see it in the next 12 months. . . . Sure, we're looking at CMOS, but the prospect that we'll do something with a CMOS 8086 is highly speculative at this point. It could be an 8086; it could be an 8088 or a Motorola 68000," implying that the unit will have 16 bits rather than the current 8 bits.

Finally, Yamagata assessed Radio Shack customers, agreeing that sophisticated programmers have always appreciated TRS-80s—Color Computer owners, for instance, seem more passionately attached to their micros than are Commodore appliance buyers—but adding that Tandy by no means intends to become the machine of the loyal minority.

"I think we're going to have both," he predicted. "I think you'll always have the hobbyist; I think he'll always enjoy buying and working with Radio Shack products. Also, we would like to be in the mainstream of the business. I think we still are, and I think we're going to increase that."

"I just don't feel that we've lost that much. People are saying that we have, but we're not going to change our strategy any more than we have before." ■

—E.G.

Second-quarter reports

Problems for Atari, TI, Osborne; joy for chip makers.

In mid-June, when Texas Instruments announced an expected loss of \$100 million in its second quarter, other micro manufacturers' stocks nosedived in a fallout effect (see *80 Micro*, October 1983, p. 286). When the official figures were announced, TI had lost \$119 million or \$4.71 per share—including profits from other divisions. The home com-

puter group lost \$183 million, and TI and two other companies had combined losses of over half a billion dollars.

TI's two partners in trouble were Mattel Electronics, which reported a \$24 million second-quarter shortfall, and Warner Communications' Atari, which dropped a whopping \$310 million. By late July, TI became the fourth

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home computer supplier in two months to change presidents, and a day's gossip about the IBM Peanut sent TI, Warner, Coleco, Commodore, and Tandy stock down by several points.

Meanwhile, portable pioneer Osborne Computer Corp. was firmly denying deathwatch rumors, while closing one of its two plants and slashing \$500 from Osborne 1 prices. The personal computer industry, in case anyone hadn't noticed, was shaking.

At Texas Instruments, President J. Fred Bucy joined acting Consumer Group President Jerry Junkins in assuming responsibility for the firm's computer products. (Consumer Group President William Turner resigned, describing the move as "very voluntary" and looking forward to getting "back into the industrial sector" at Automatic Data Processing of Clifton, NJ.)

Bucy and Junkins' main tasks will be to reduce TI's overhead and bring manufacturing costs in line with today's price structure—"a structure," *Electronic News* noted, "TI helped to create with an aggressive rebate program."

Other manufacturers—even Commodore, which has shuffled presidents frequently but has remained almost alone in keeping healthy despite the low-end market chaos—waited anxiously to see whether TI would cut prices still further, dropping its 99/4A to some \$50 to clear inventories for the 99/8.

Even so, said Merrill Lynch vice-president Thomas Kuriak, "[TI's] prospects are bleak. I don't think there'll be a good market for the 99/8. It's coming in as a me-too for the [Commodore] 64. That market may be saturated by now, anyway."

TI's other product lines are faring no better. "Delay in availability of peripherals for the portable Compact Computer 40 has caused us to reduce its projected volume for 1983, resulting in inventory writeoffs," the company's second-quarter report admitted, while sales of TI's Speak & Spell and other "electronic learning aids declined from their already low level of the first quarter."

The desktop Professional Computer, which *EN* reports "is said to hold the greatest promise for the growth of TI's data systems business," faces an uncertain future, too. Stewart Carrell, executive vice-president for corporate devel-



Endangered species #1: The Timex-Sinclair 1000.

opment and marketing, had recently been put in charge of the product, but resigned—a surprise for TI, compared to Turner's expected exit—and left no clear successor.

Nevertheless, TI ignored pessimists such as Merrill Lynch, which lowered its estimate of the firm's 1984 earnings and advised clients, "An exit from home computers would make us more positive." Pointing to its profitable business in semiconductors and memory and logic circuits, TI's report repeated its belief that technological innovation, not marketing skill, will bring success.

Judging from competitors' actions, that's a minority opinion. Last April, Apple hired President John Sculley from Pepsi-Cola. Arnold Greenberg, president of Coleco Industries Inc., told *Business Week*, "We have always felt that marketing is the key." And Atari, in the wake of President Raymond Kasar's resignation, hired James Morgan, former executive vice-president for marketing at Philip Morris, to take the reins.

Looking at Atari's unbroken string of quarterly losses and the wreck of the video-game industry, Morgan told *BW*, "Atari's strength as a name also tends to be its weakness. It is synonymous with video games, [so that the computer] consumer looks at that name and sees 'game.'"

In addition to redefining its image, Atari must, like TI, reduce costs. The Warner subsidiary has eliminated full

computer assembly operations in the U.S., turning to manufacturing plants and contractors in the Far East. Even so, *EN* says, retailers are unhappy with the \$199 suggested list price of the low-end 600XL, "commenting that \$120 pricing would be more in order."

"Atari has still not priced [the three other] computers it unveiled last June," *EN* adds, speculating that, "in addition to figuring out costs in the Far East...[Atari] is waiting to see what further downward directions home computer prices may take."

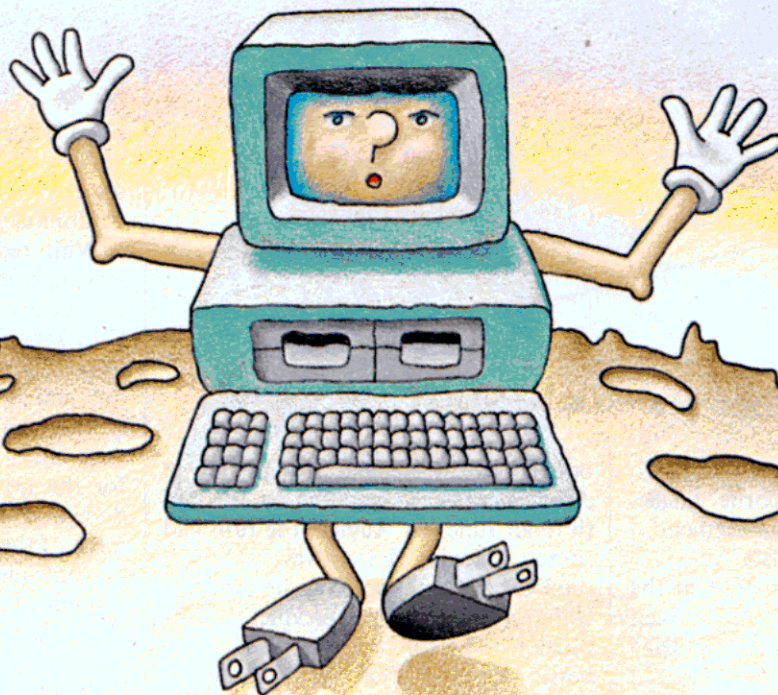
Two other firms are reportedly considering phasing out their base products in favor of more powerful, equally inexpensive models. Timex, whose new 1500 and 2068 are partially made in the Far East, is probably close to dropping the TS1000, "which by most accounts has come to a virtual halt in retail sales."

At Mattel, where president Joshua Denham stepped down in favor of William Mack Morris, the Aquarius computer console may be shelved when the Aquarius II, with more memory and a fuller keyboard, is introduced. A similar overlap confuses the relationship between the company's Intellivision II and III game machines.

Mattel, too, is trying to cut overhead. Early in July, the Hawthorne, CA, firm laid off 260 white-collar workers—about 15 percent of its total operating and administrative staff.

Moving away from the low-end market, Timex and Mattel can sympathize

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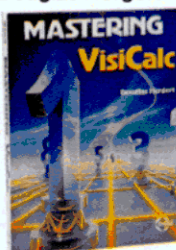


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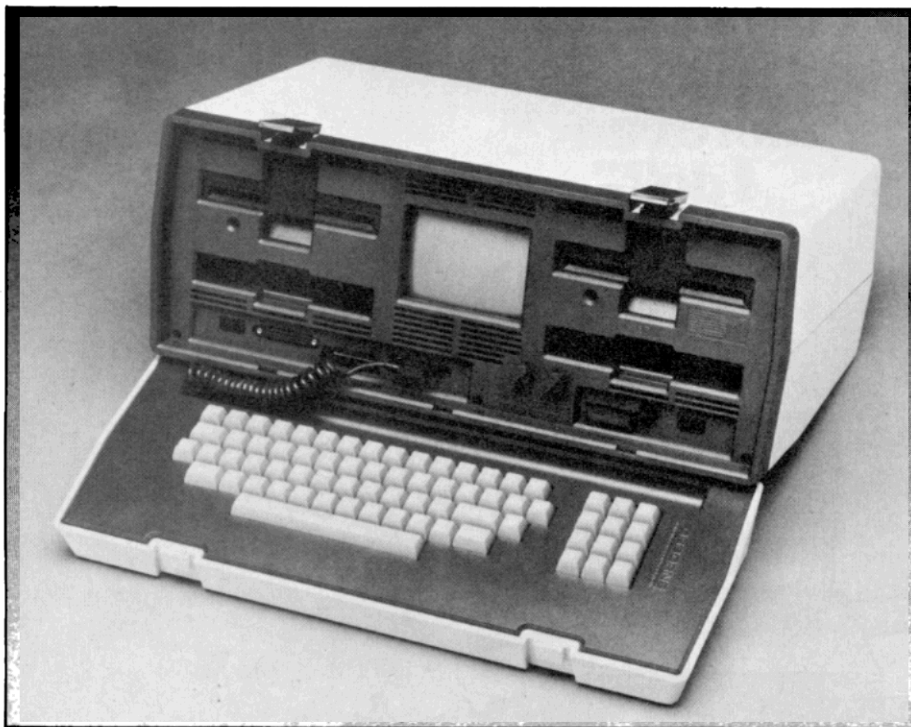
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SYBEX COMPUTER BOOKS



Endangered species #2: The Osborne 1.

with Adam Osborne, who ran into cash flow problems when Osborne 1 sales stopped dead with the announcement of the Osborne Executive in late April.

While buyers showed interest in the \$2,495 Executive, with its 7-inch screen and promised add-on board for IBM PC compatibility, the two-year-old original Osborne became a back number. In June, Osborne added the Personal Pearl data base manager to the \$1,795, 5-inch-screen portable's software package, but dealers continued to report slow sales even at discounted prices. Kip Garlow, manager of The Xerox Store in Chestnut Hill, MA, told *ISO World* that he'd had to drop his Osborne 1's to \$1,095: "It's the only way we can move them."

According to Yankee Group analyst Chris Christiansen, it's believed Os-

borne "did not make any money in April" and was operating in the red through June. By August, the firm had started shipping Executives, although the PC board, supposed to be available within a month of the product's introduction, was still not ready. The Osborne 1, meanwhile, officially came down to a price of \$1,295.

During that time, the company shut down its Monmouth Junction, NJ, plant, laying off 89 workers, and dropped 203 quality control and service staff from its Hayward, CA, facility. Spokesmen described the closing of the East Coast satellite, which produced 200-250 Osborne 1's daily, as a step to greater efficiency; the California plant, "scheduling production as demand dictates," can build 800 Executives a day, or a fewer number and some 1's.

Jim Howell, son of Exatron founder Robert Howell, has taken over end-user sales of the Exatron Stringy Floppy (see *80 Micro*, September 1983, p. 294). His firm, A & J Micro Drive, sells and supports ESF drives, wafers, and programs.

Besides having ample stock, Howell said, he has the right to manufacture stringy floppies for future consumer sales once OEM vendor Entrepo Corp.'s supply runs out.

A & J Micro Drive's address is 1050 E. Duane Ave., Suite I, Sunnyvale, CA 94086, 408-732-9292.

Reached by *The Wall Street Journal*, Adam Osborne said that demand for the older model fell off sharply since the Executive's debut, but that Executive sales also slowed and inventories of that machine had increased. "The whole industry is in something of the doldrums," the company's chairman and founder claimed. "What's happening is, we're seeing some summer softening."

Analyst Christiansen rejected that theory, saying that Osborne, which "miscalculated the life cycle" for the first machine and then "never figured plans for the Executive would go that far awry," would "never regain its place as the industry leader." Christiansen commented to *ISO World*, "I don't see a summer slump affecting Kaypro or Compaq sales."

With red ink and laid-off workers seemingly everywhere, there were still a few micro success stories to be seen. IBM kept second-guessers buzzing with rumors about its bargain-priced Peanut, and Apple Computer Inc. cheerfully reported an 87 percent increase in sales and a 59 percent boost in profits for the quarter, with accelerated production of the IIe and on-schedule shipment of the first Lisas.

Apple also held its own in the gossip columns, with the return of Apple I and II designer and Us Festival sponsor Steve Wozniak to the company. Wozniak, who left Apple after a plane crash in February 1981, told *InfoWorld* he was happy to be back: "It's very friendly—going out to dinner with engineers, talking about which ideas make sense for a product, what should be compatible, what should be standard."

While *InfoWorld*'s Paul Freiberger reported Wozniak "modestly says he is just dabbling in a few simple projects for the Apple II and III," Woz told both *IW* and *MicroScope* that he is thinking about a new computer. The latter magazine claimed it would be "a cheaper machine, with fewer parts," and more Lisa-style software; Freiberger quoted Wozniak as musing over ultra-high-resolution color graphics, "where in an icon every pixel has a different color."

As for the short-term future, speculation about Peanut and McIntosh—to make way for which, retailers whispered, Apple IIe prices might go under \$1,000, perhaps as low as \$700—combined to steal some of the thunder Coleco had started with the announcement

of Adam. Vendors wondered whether Adam's tentative \$600 price would leave them any margin for profit, whether different versions would appear with and without the ColecoVision game module, and whether the system's inexpensive daisy-wheel printer would bear up under heavy use.

A Sears spokeswoman told *Electronic News*, "We're still analyzing and reviewing [Adam] at this point. In the last three months, [computer] demand has been less than anticipated." Echoed Child World's vice-president of marketing, Jack Mueller, "We haven't made a decision [on Adam] yet. We're trying to figure out where the margins are. We don't need a \$600 loss leader."

By mid-August, Coleco stock slipped to \$30 a share from its June high of \$65, and a Wall Street securities analyst told *80 Micro*, "Wall Street is betting heavily that Coleco is going to go down." Investors, the source said, were growing anxious about Adam's being late, missing its September debut or even some of the Christmas market; in addition, pessimists pointed out that only one Adam had ever been seen—the one Coleco displayed at the Consumer Electronics

Show in June.

Put options—what people buy when they think a stock is going to decline—were hot properties, the analyst continued: "You cannot buy a put option on Coleco now. People are just waiting for Coleco to die so they can collect on their put options."

Coleco, for its part, expressed confidence in its product and pricing, comparing pre-introduction talk to the nay-saying that preceded ColecoVision's debut last year. President Arnold Greenberg said in August 16's *Boston Globe*, "We take a certain pleasure in being the company others say can't do it, making the product others say can't be made. For us the joy is in holding the trump card, knowing that in 30 days Adam will speak for itself."

Finally, there was unshadowed prosperity among chip manufacturers. Intel's profits tripled in the second quarter on a 20 percent boost in revenues, while National Semiconductor Corp.'s revenues climbed 13 percent.

And Harris Corp. might be a name to remember. Working with Intel, the minicomputer and communications firm introduced the 80C86, a CMOS

version of the wildly popular 8086 16-bit microprocessor, which requires only 10 percent of the power, can operate over a broader temperature range, produces less heat, and is less sensitive to electromagnetic noise than the original.

Besides selling 80C86s—the first customer is reportedly Japan's Kyocera Electronics, makers of the TRS-80 Model 100, which promptly led columnists and analysts to predict an improved, IBM-compatible Tandy portable by late 1984—Harris announced its intention to acquire Lanier Business Products, slugging it out with Wang and DEC in the office automation arena.

As the industry's most hectic summer drew to a close, talk of Adam, Peanut, McIntosh, and 80C86 portables was beginning to replace talk of corporate chaos. The consensus seemed to be that some companies might not see next summer, but that the survivors would offer impressive products—that, with computer makers jockeying for position, the consumer would come out ahead. ■

—E.G.

Oklahoma modem blues

Southwestern Bell raises the ante.

The local telephone company sees it as a matter of enforcing the rules on the books, but worried sysops see it as Oklahoma's secession from the Network Nation. Citing a 1965 tariff designed for business data transmission, Southwestern Bell has assigned a different service rate—in effect, a 500 percent monthly increase—to anyone who connects a computer and modem to a residential phone line. According to Norman, OK's Robert Braver, president of the Oklahoma Modem Users Group, the Information Terminal Service tariff "for all practical purposes prohibits non-commercial, hobbyist modem use," boosting customers' rates from \$8.95 to \$45.90 monthly. Touch-Tone charges increase from \$1.25 to \$3.50.

The higher rate applies to "customer-provided data transmitting and receiv-

ing equipment that process[es] data and/or perform[s] calculations," the tariff says. "Examples of data transmitting and receiving equipment would include computers, associated buffering devices and/or concentrating devices with store and forward capabilities located on the same or different premises."

Braver discovered the tariff the hard way, seeing his bill skyrocket after the company found him on-line. In the words of Southwestern Bell spokesman Walt Beiter, "We had an incident arise where we had some phone work to do on a customer's line here in the Oklahoma City metro area, and discovered that he had terminal equipment on the line, and applied a rate that we've had on our tariffs since the 1960s and that applies to terminal hardware."

Since then, Braver has been protesting and raising publicity via fellow

e-mailers and the news media. Generally, he feels the tariff is obsolete; specifically, he wonders why it's risen from obscurity only now.

"It's a 1965 tariff, and why they're enforcing it now instead of earlier I don't know," Braver told *80 Micro*. "It's outdated. It really doesn't apply to anyone anymore, including business, because any business that's transmitting data these days is probably using a high-speed modem on their own dedicated line."

Southwestern Bell agrees. A company spokesman, while defending the surcharge, admitted to *The Wall Street Journal's* David Stipp, "Technology has sort of surpassed some of the tariffs we have on file."

Interviewed by *80 Micro*, Southwestern's Beiter said, "We're aware that this tariff that's been lying out there in the

books for 20 years needs to be redesigned. While the tariff doesn't mention business or residential usage, the thinking [behind it] was really business and heavy line usage, and of course the situation has changed. We're in the midst of a rate application in which we're doing a number of new rate designs, and we're going to redesign that tariff in our new rate application."

Oklahomans won't see the revised tariff until this fall at the earliest, after Southwestern's application has made its way through hearings and gained the approval of the Oklahoma Corporation Commission.

"We've had one rate hearing so far," Beiter said, "at which different people gave their sides, and one group that was heard from was these computer users and home terminal users. We said at that time in front of the commission that we recognized that we had a problem with the tariff and we were going to do something about it."

As to what Information Terminal Service's replacement will be, Beiter said, "We haven't come up with the kind of rate we're going to apply, but we're looking at some kind of usage rate. We're looking at a new terminal equipment or terminal rate approach, in which the charge applies to how much you use the line. We're going to update that tariff and change it one way or the other for sure."

Though the new rate might involve time spent on-line rather than a flat \$45.90, that still means extra costs for modem users. Beiter defended the dif-

ference, saying, "It's not an increase. We're talking about two different rates in effect. One applies to basic home service and the other applies to terminals on the line."

The news that Southwestern Bell was enforcing an antique tariff coincided with the approaching breakup of AT&T, which will separate local from long-distance companies and force the former to look for new sources of revenue. However, Beiter insisted, Southwestern's policy was nothing new: "When we're aware of that type of equipment being on the line, it's always been enforced. Any time we're aware of a piece of equipment being on the line, we apply the rate that needs to apply."

But Braver takes a more suspicious view. While several states, including those served by Mountain Bell and Southern Bell, have similar tariffs, Braver pointed out, the present controversy "is only Southwestern Bell and it's only here in Oklahoma. The [governing] commissions are only statewide. Apparently they thought they could get away with it in Oklahoma."

Can users get away with owning a modem? Direct-connect buyers are supposed to notify the local phone company of their purchase, and Braver claims keeping any modem secret is impossible: "If you have an acoustic modem you don't have to tell them, but they know every time you put your modem on line. Any time you put a foreign tone on the phone line of a certain duration or quality, it's recorded. This is to record toll fraud. They're not doing

anything with it now; they do have the capability to start doing neat things with that information, as they admitted in *The Wall Street Journal*."

Actually, Stipp's article read, "The telephone company doesn't try to discover who is transmitting data over its lines, says a Southwestern Bell spokesman." It then quoted Lee Selwyn, a telecommunications expert with the consulting firm Economics & Technology Inc.: "It's not hard technologically for the phone company to monitor the lines, but whether that's an illegal invasion of privacy is difficult to tell."

For his part, Beiter dismissed thoughts of modem paranoia: "We're not out making any search trying to check back to see who may or may not have terminals on their line or anything else. We're not going back in the records to do a witch hunt on it."

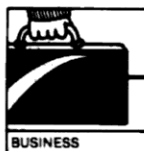
Meanwhile, Braver's group is acting as a lobbying organization, relying on press attention and perhaps a lawsuit to stop Southwestern. "We're trying to raise funds to initiate some legal proceedings," Braver said. "We haven't retained an attorney yet, but hopefully we'll be moving in that direction very soon."

"This has sort of turned into a test. If they get away with it here, there's no doubt that they're going to start applying it in other areas. If nobody does anything about it, or if we try and fail, I'm afraid it's going to be open season on modem users in the U.S." ■

—E.G.

PULSE TRAIN

Keeping it in house



What's the largest advertising agency west of the Mississippi River? No, it's not some swank Los Angeles firm, producing ads for a dozen famous companies. In fact, the agency has only one

client. It's Radio Shack's advertising division, taking the entire third floor of the 19-story Tandy Center One tower in Fort Worth, TX.

According to *Computer & Electronics Marketing*, the Shack's in-house effort—145 people spending \$160 million a year—is the biggest of its kind in the U.S. Radio Shack, one of the 20 largest advertisers nationwide, is the only company to prepare its

own copy and commercials. The industry journal *Advertising Age* could find only one other private advertiser among its top 100.

Such a policy defies conventional wisdom. Don Ambuhl, senior vice president of the American Association of Advertising Agencies, told *C&EM's* Herbert Swartz that in-house advertising, especially for large companies, is "foolhardy." While the cost

of mounting a campaign may be less than an agency's 15 percent commission, Ambuhl said, "When one share point can be worth millions of dollars, saving \$100,000—or even a few hundred thousand—is illusory."

Beside, Ambuhl claimed, an agency's talent is energized by working on different products for different companies. "In-house advertising can't attract the best peo-



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ple," he said. "There is simply better compensation and more opportunity and potential on the agency side. The professional rewards are greater, as are the chances for personal growth."

In Fort Worth, Bernard Appel isn't buying that. Said Appel, Radio Shack's executive director for marketing, "I disagree that we don't get the same intellectual ferment. There are creative people here from all over the United States. And I spend more money in my single division—what I'm handling right now—than most agencies do with 15 clients."

"Agencies out there are handling several different products for several different clients," Appel said. "Well, I'm handling several different products also—even though they all come from one client. [And] when you're working on a single account as we are, you start to build up a loyalty to the account—much more so than you would if you were working on 10 separate ones."

Also, Appel pointed out, Tandy's copywriters, artists, and TV producers have extra incentive: "Most of us are stockholders in the company, so obviously everything we do is going to be reflected in sales and profits."

Does it work? Tandy's general advertising manager, Mike Wood, told *Marketing & Media Decisions* that Fort Worth's minimum goal "is to achieve 60-percent coverage of any market that we're in." To do that, Radio Shack buys space in 1,080 newspapers a year, produces an annual catalog, monthly general flyers, and bimonthly Computer Center flyers, and dips into TV and magazine advertising. The result, over the last five years, is a net sales rise for Tandy of 92 percent, with Radio Shack accounting for the lion's share.

"In short," Swartz concludes, "Radio Shack's adventure may not be for everyone—maybe, alas, just for Radio Shack—but no one in Fort Worth is complaining."

The last word in software



Now that computers have become a fact of life, Lassen Software of Chico, CA, is

ready to make the IBM PC a fact of death. Personal Lawyer/Wills, a new \$50 PC program, uses information about your relatives, estate, and last wishes to create and print a will and testament that's legal in 49 states.

According to *InfoWorld's* Tom Shea, the program asks as many as 80 questions, beginning with your name, address, and marital status, and going on to where you want the executor to dispose of your ashes if you want to be cremated. Its proprietary software technology, called a "text builder," incorporates your responses into blocks of standard legal language stored on disk.

"The language," Shea reports, "is determined by the user's personal circumstances and by the state he lives in. The length of the will can range from seven to 20 paragraphs." The finished will is printed immediately, rather than being saved to a text file where non-lawyers could make invalidating changes. Signed and witnessed, it is a valid legal document in every state except Louisiana, whose system is based on the French Napoleonic code.

Lassen Software president Frank Holt, while admitting the program "certainly doesn't fit the needs of every-



New IBM PC program: "Being of sound mind and micro..."

one," claims "it should satisfy the needs of about 95 percent of the population," as long as users' estates aren't too complex.

Attorney Doug Jacobs, who originated Personal Lawyer/Wills, reassures PC owners that its use does not constitute practicing law without a license. "The program is meant to bridge the gap between going out and buying a book about wills and then using the book to write your will, and going to your attorney," he concludes.

Jacobs told *InfoWorld* that he plans additional packages such as Personal Lawyer/Leases and Personal Lawyer/Temporary Child Guardianship. The wills program's documentation, meanwhile, includes a humorous sample will demonstrating how *Star Wars* swashbuckler Han Solo disposes of his light saber and other property; Jacobs may need to consult 20th Century-Fox and Lucasfilm about Personal Lawyer/Copyright.

Radio Basic



Since 1978, the Dutch Broadcasting Corp., NOS (Nederlandse Omroep Stichting), has carried nonprofit software publishing to its limit. Not only has the Netherlands network created an "Esperanto" version of Basic compatible with 17 different computers, but it sends Basic programs over FM and medium-wave radio.

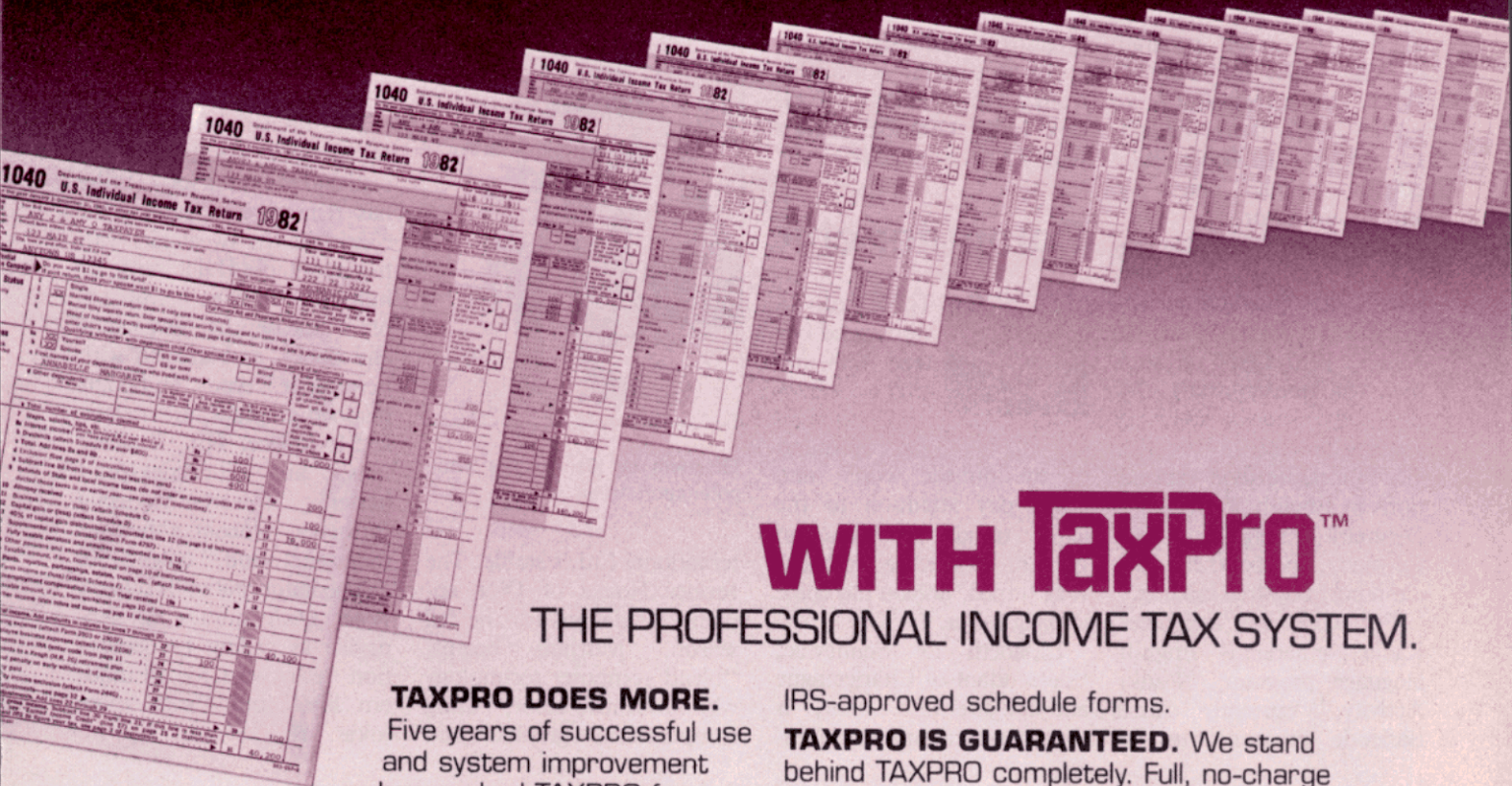
When the NOS show "Hobbyscoop" (pronounced "Hobbyscope" in English) transmitted its first computer program, producer Hans Janssen remembers, "many listeners wrote to ask if there was something wrong with their radio receiver." Apple, Exidy, Pet, and TRS-80 owners took turns on the weekly broadcast, each group transmitting machine-readable data once a month.

However, the CLOAD-like sounds didn't thrill general audiences; two of the machines' slow baud rates meant "up to eight minutes of objectionable noises" per show, and cassette interface systems proved "rather unreliable." To simplify the process, radio amateur Klaas Robers developed Basicode, a standard protocol for storing and retrieving Basic programs from cassette, in 1982. An improved version, Basicode-2, has been used on-air since January 1983.

In addition to the four original machines, Basicode works with BBC, DAI, Heath, OSI, Philips, SWTPC, and CP/M micros. NOS makes machine-language translation programs available for each model; a few (such as the TRS-80 I/III) also require a simple hardware interface.

Basicode supports some 50 instructions, forming a sub-

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set of standard Basic. Since different machines do the same things in different ways, line numbers below 1000 are reserved for standard subroutines contained in the translation program (GOSUB 100, for example, clears the screen—CLS to Radio Shack users, HOME to Applesoft). Other rules govern variables use, line length, and so on.

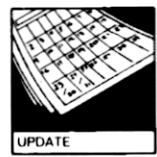
Programs are broadcast by NOS at 1,200 baud. "Hobbyscoop" airs Sundays at 1810 Greenwich Mean Time in winter, 1710 GMT in summer, on medium-wave 747 KHz; the show's computer segment (around 1840 or 1740 GMT) includes short explanations in English. Listeners in Denmark, Belgium, West Germany, and southern Britain report bug-free loading.

For worldwide audiences, Radio Netherlands' English-language program, "Radio Activity," currently carries Basicode programs to the

U.S., Canada, Australia, Sweden, Pacific islands, and parts of Africa and Asia.

Information on Basicode, including shipping prices for a handbook (in Dutch and English) with translation programs on cassette, is available from "Hobbyscoop," P.O. Box 1200, 1200 BE Hilversum, The Netherlands.

Computer chic



Those of us who spend our time with micros sometimes forget the tinsel and glamour of the outside world, and don't pay attention to the latest trends in European fashion. Well, while our backs were turned, fashion has come looking for us.

Elisabeth de Senneville, "descendant of Charlemagne and daughter of a Count," is the newest star in Murjani In-



Elisabeth de Senneville's computer sportswear.

ternational Ltd.'s stable. The former House of Dior apprentice's designs for the fall season, Murjani beams, "blend computer technology with innovative color," using computerized graphic and

newspaper prints rather than mundane patterns.

Says de Senneville, "I have a passion for computers. Today, even children are learning to use them. I am the opposite of high fashion. My computer prints are mass art—an image of our times."

The designer's "image of our times" combines high tech and the punk look. "She has reinterpreted such great classics as the sweatshirt with her inimitable Gallic sense of humor," declares a Murjani press release; her sweatshirt and slacks, emblazoned with newspaper type and bit-mapped graphics, are a classic \$48 apiece. For "Dallas" fans, an oil-derrick-print blazer, "irreverently using Burberry raincoat fabric as the background," costs \$150.

The authoritative *Women's Wear Daily* quotes de Senneville as calling her collection "easy wear for all modern life," but "with more jokes." ■

Monster merger gossip

● No sooner does someone start a rumor that CP/M is dead, beaten by Microsoft's MS-DOS, than a new rumor claims that **DIGITAL RESEARCH INC.** is making a comeback, working with VisiCorp on combining Concurrent CP/M with the VisiOn integrated software system. The hottest rumor of all, according to the Yankee Group's Chris Christiansen, is that DRI and VisiCorp are planning a merger, making the resulting firm the largest software company in the world.

● Maybe their Ataritel line will save Atari after all: While the low-end micro market is in shambles, Tandy expects to prosper in the post-AT&T **TELEPHONE** business. After the success of four prototype stores in Texas and Kentucky, Radio Shack will open another 21 Telephone Centers in the next few months.

According to President John Roach, the Fort Worth, Dallas, Louisville, and Lexington stores—which emphasize phone systems with two to 16 incoming lines—have attracted "an enthusiastic response from both business and residential

consumer markets." Of the new stores, 11 will be start-up operations, while 10 will share space with existing Computer Centers.

● Meanwhile, **IBM** completed its purchase of 15 percent of Santa Clara, CA's Rolm Corp., a maker of PBX and other telecommunications equipment. And, proving that the computer/phone cash-in goes both ways, *ISO World* reports that Western Electric Co., not AT&T Information Systems (formerly American Bell), will produce the first micro from an AT&T company—a Unix-based desktop system with bit-mapped graphics, expected to debut in November.

● Since 80's New Products section is reserved for TRS-80 items, End Bytes has the honor of mentioning Glenn and Marilyn Borchardt's Compupak, an oversized **BACKPACK** for carrying Osborne, Kaypro, or similar portable computers. Explaining the need for a \$139 satchel to handle hefty micros, San Francisco scientist Borchardt says, "If you carry an Osborne for more than a block or so, your arm just gets torn out of its socket."

On the other hand, Karen Klein of JMM Enterprises—an Enunclaw, WA, company that makes Osborne over-the-shoulder bags—told the *Boston Globe*, "I don't know of many executives who carry their Osbornes on camping trips. I'm sure they would want a more professional image, such as a very large briefcase, not a backpack."

● Micros are making headway **OVERSEAS**, says *Computerworld's* "International Report." Japan's Elec-

END
BYTES

tronic Industry Development Association expects personal computer shipments to double in the next two years. In Spain, Commodore's chief says his firm's lead in micro sales is threatened by a pincer movement from Apple and IBM. (Hispano Electronica S.A., the exclusive wholesaler of TRS-80s in Spain, has suspended payment to suppliers and is thought near bankruptcy.)

As for Europeans' attitude toward micros, a poll by West Germany's Society for Mathematics and Data Processing says that 73 percent of persons surveyed equate data processing with progress. Unfortunately, 74 percent also connect the idea of computers with unemployment.

● A new firm, BackUp-80, intends to offer **SERVICE**—in application advice and troubleshooting, not maintenance and repairs—to users of TRS-80 hardware, software, and peripherals. RS owners interested in on-site setup and training, or a telephone assistance subscription, can contact BackUp-80 at 160 N. Main St., Randolph, MA 02368, 617-963-2280.

● Another new business shows the extent of today's micro **SPECIALIZATION**. Softmart—The PC Software Store, located in downtown Philadelphia, sells only software, only for IBM PCs and PC-compatibles.

● The multiple-choice moguls at Princeton, NJ's Educational Testing Service have added **PASCAL** to their curriculum: In the spring of 1984, high school students will be able to take an Advanced Placement test in computer science, focusing on the structured programming language, for college credit. AP Pascal joins a long list of honors courses in English, physics, history, and other subjects in secondary schools nationwide. ■

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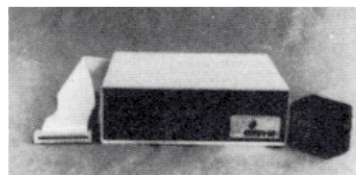
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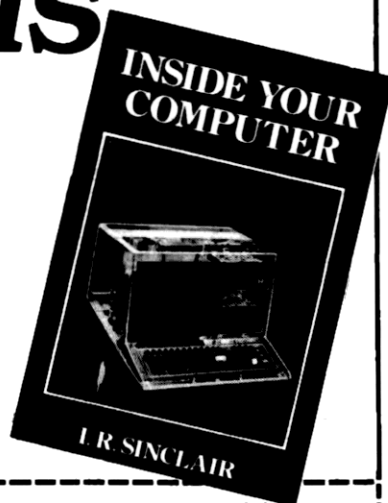
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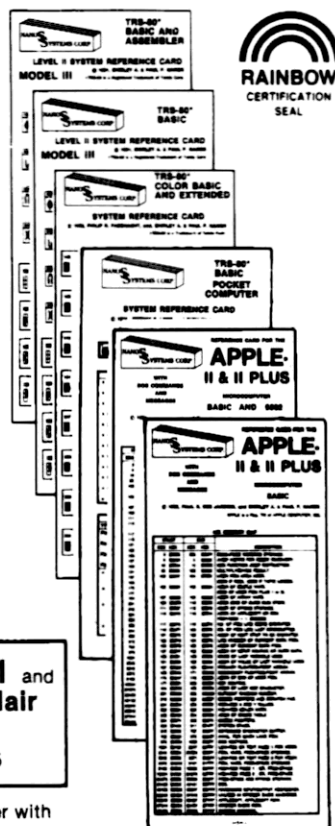
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The Silvers' reunion

Mad Max, Editor-in-Chief!" Max was yelling and jumping on the bed in the Holiday Inn where Mercedes was making us stay to clean up before meeting her family in Baltimore.

"Mad Max, uncle," Mercedes said, coming from her room with *The Beginner's Guide to Computers* under her arm. "Do you think this would be a good present for Meredith?"

"Pay attention," I told her, waving the letter from New Hampshire. "We're supposed to edit an anthology of games from *80 Micro*."

"I couldn't give that to a baby," Mercedes said, preoccupied. "Geez, I get a new baby brother and I'm not even there. I'm in Florida with a bunch of real estate salesmen. It's not like I have a normal home life or anything."

"Coming next summer!" Max cried. "T-shirts! Movies! Gamer's Cafe action figures!"

"Maybe I'll write a language for him," Mercedes continued. "Xerox has Smalltalk. I wonder if anyone's done a language called Babytalk."

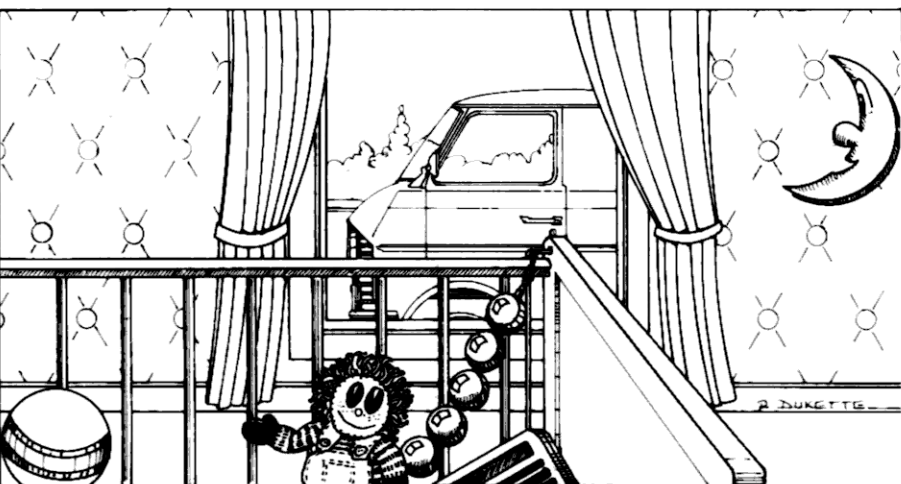
"First we judge the one-line contest; now we have to pick the best games from the magazine," I said. "If *80* gave us a raise, we could afford room service."

"Turn off the highway here and get onto St. Charles Avenue," Mercedes directed. "There's something I want to do before going home."

"You said 11 o'clock when you called somebody from the motel," I said. "Wasn't that when your folks are expecting us?"

"No, that's an appointment," Mercedes frowned at herself in the vanity mirror and tugged her hair. "And I want to do some shopping afterwards. You guys'll have to amuse yourselves for a few hours without me."

"We could go to Edgar Allan Poe's grave or Wallis Warfield's house," Max



said, peering into his official Baltimore Tourist Guide.

"We could always work on the column," I reminded him.

"Yeah, well, drop me off up here, Rodney," Mercedes said. When I pulled over, she jumped out of the van, squared her shoulders, and walked into—

"Fort McHenry Coiffures?" Max gaped.

"She's getting her hair done," I breathed, transfixed. "Mercedes is getting her hair done." We looked at each other for a while.

"Our little girl is growing up," Max said.

Max and I didn't feel like going sight-seeing without Mercedes, so we sat on a bench in Mount Vernon Place and split the month's Cafe mail into two piles.

"A letter from John Hope, former Sea Dragon champ of Kingston, Ontario," Max read. "He's made a comeback with Rear Guard."

"R. de Landsheer from—somewhere in Belgium? I can't read the handwriting—"

Max looked over. "The postmark says Kraainem."

"—broke the record in Apple Panic," I noted. "And Chung Lee of La Canada, CA, scored 22,980 on Jungle Boy. He says to jump on the first swing on the first vine, then the third swing on the next, then the first, then the third, and so on. On the third screen, don't use the left and right arrows; just jump and duck at the right time."

Max opened another letter. "Some

guy wants us to say 'Hi, Frank' in the column."

"Don't do it," I advised.

"No way," said Max. "Start that, and we'd get people sending birthdays and anniversaries."

We were unprepared.

"Mercedes!" Max squeaked. "You're a brunette!"

"And you're wearing a jumper," I said absently. But Max and I were both staring at her hair. It was light brown and cut in a pageboy or Dorothy Hamill or whatever they call that style. I don't know these things.

"Yeah, well, whoever heard of an 11-year-old with gray hair?" Mercedes said defensively. "The real color kept showing at the roots. And can't anyone outgrow the punk look around here?" She brushed past us huffily and took her seat in the back.

"Our Mercedes," Max murmured. "She'll probably start talking about horses and boys all the time."

"I heard that," she called.

"Probably change her name to Tandy White."

"I heard that."

After seeing the undyed Mercedes ("She pierced her ears, too," Max muttered), we were surprised again by Mr. and Mrs. Silver. I'd expected Mercedes' dad to look like Charles Durning, but Maryland's leading Radio Shack dealer was a trim, preppy-looking fellow not yet 40.

For his part, Max was captivated by

Mrs. Silver, a willowy Dress-for-Success type who looked more like a successful architect (which she was) than the mother of two. The new baby, of course, was the highlight of the house tour; Mercedes' rushing to see him forestalled the awkward "So you've been carrying my daughter around in a van" conversations I'd anticipated.

Meredith was sitting, Jabba the Hutt-like, in his playpen, surrounded by toys—a teething ring, a Radio Shack beach ball, a partially disassembled MC-10. There was a mechanical toy turtle in one corner, which he had apparently pulled limb from limb.

"Like his sister," Mr. Silver confessed. "They say kids are wild about Logo, but mine hate it."

"A wonderful baby," Mercedes cuddled him. "And he's got five little toes on his foot! How many toes, baby? For T equals 1 to 5: Count T: Next."

While Mercedes played with her brother, the senior Silvers offered us a late lunch.

"I don't know how you break even out on the road," said her business-minded dad. "I sell TRS-80s to all kinds of people for business, for word processing. For serious stuff. I told Mercedes I'd support her interest in programming whatever she did, as long as she didn't get mixed up with 6502s. But game customers expect Apple graphics."

"He's standing up! He's standing up!" Mercedes cried. "No, he fell down."

"But the important things about TRS-80 games aren't graphics," Max declared. "What's important is the sense of destiny, of the game player as a minimalist, a purist." He recited most of his August Proof Notes column before Mrs. Silver stopped him by passing the potato chips.

"All the same," Mr. Silver continued, "kids come into the store wanting to play Pac-Man. What can I tell them?"

"Scarfman," Max said through a mouthful of chips. "We got a letter about it from Don Greene of Johnsbury, NY. Been playing ever since. Did you know that at level 9 you can expect

to lose one man per screen on average?"

"Really?" asked Mercedes' mother.

"Absolutely," Max said. "You have to sacrifice him to be left with a pattern of pies and an energizer near the bottom that you can get with the second man. The level 9 monsters are flawed, though. They rarely chase you through the wraparound passage, and in their benign state they can be chased out of an area you want to clean up. Don says you can practically herd them like sheep sometimes."

"Go on, baby," Mercedes was saying. "Crawl to your Uncle Max and back to me. Gsub Max, return."

Later, I heard laughter and explosions from the nursery. "I don't believe it," Max said. "She's got him playing Eliminator."

"Good boy!" Mercedes cheered as Meredith hit Enter and another smart bomb blew up the bad guys. Meredith gurgled happily.

"We printed a 99-ship patch in June," his sister explained, "so Bob

The Big Board

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Bable Terror	8,857	Mad Max
Barricade	17,520	Troy Scrapchansky, Uncasville, CT
Caterpillar	362,883	Alvah Werner, New Albany, OH
Centipedes	94,836	Belinda Chron, Tempe, AZ
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Weerd	61,180	Tommy Seniuk, Vegreville, Alta.
Wild West	15,400	Gorman Miller, Titusville, FL

*Expert mode: 339,080 (David Smith, Kingwood, TX).

Gamer's Cafe readers are invited to submit their high scores, preferably with screen photos, for these and other Model I/III/4 games. Sorry, but we are no longer accepting entries for Color Computer games and, due to known bugs or ridiculously high scores, the following: Alien Defense, Armored Patrol, Bounceoids, Eliminator, Galaxy Invasion, Liberator, Skyscraper, and Strike Force.

Smicinski of Amsterdam, NY, decided to add unlimited smart bombs. From TRSDOS Ready, you type in LOAD ELIMINAT, then go into Basic with a memory size of 32767. Type in POKE - 26489,0: POKE - 26488,0: DEF USR = - 29927:X = USR(0) and enter. After that, every time you hit the enter key you'll get a smart bomb, but the number of bombs won't be reduced."

"Good thing we took Eliminator off the board," Max said admiringly. "Meredith's got 2 million."

After Meredith was asleep, we made

plans.

"You guys drive to Peterborough and see about this anthology," Mercedes decided. "You can start working on the games, and I'll do the technical stuff on weekends. I'm going to stay here and pick up the master's diploma and say goodbye to the gang at Johns Hopkins, and then MIT wants me to take this teaching fellowship and Ph.D. project they've got."

"Back to Boston," I said. "It was a year ago we started this nitwit column there."

"And Mercedes is leaving us," Max sobbed. We'd had some of the Silvers' sherry and were getting emotional.

"I am not," she said. "Geez, I'll meet you there in a couple of weeks. Meredith!"

"What?" We spun around as Mercedes hurtled past us—"He's got out of his crib and everything!"—and scooped her brother from the floor where he'd crawled into the room. Meredith gurgled at her, fixed all three of us with the beatific smile of a proud infant, and said quite clearly, "Mad Max."

"What?" I squawked again. "He said 'Mad Max'? The baby's first words were 'Mad Max'?" We looked at each other.

"Don't tell Mom," Mercedes said. ■

CAFE EXPRESSO



Never again, or probably never again. What started out in the May issue as a hunt for software for our broken PMC turned out to monopolize our Model 4, both our IIIs, and time we could have spent running the Cafe. We collected some of the best games ever seen outside an arcade, but typing and playing 180 entries took a lot out of us. (A half-dozen people sent cassettes, but Mercedes can type in a 255-byte listing faster than Max can type CLOAD.)

In case you came in late, the contest called for Model I/III/4 games that fit in a single line of Basic. From the raft of entries—a lot of "Guess my random number" games, which weren't too interesting; a lot of typing tutors or Simon games, though only "Mad Max Says" won our hearts—we narrowed the field to first 40 and then 15 impressive programs.

We then downloaded the finalists into one of 80 Micro's Model IIIs, and the staff rated them according to originality, challenge, and fun. Here, in mixed-up order, are the resulting top 10 games—the nine runners-up and the one-year subscription winner.

Note: These games really do fit in one line, if you type absolutely no spaces, a ? for PRINT, and use the Basic editor to squeeze them in. Type as much as you can, then press the enter key, type and enter EDIT 0 (or whatever the line number is), press X to reach the end of the line, and finish the line in the insert mode. With most, it's a good idea to enter a CLS command before running the

game; asteroids are hard enough without trying to steer a ship through four rows of dense-pack program listing.

We should also admit that Model I owners may be shortchanged by the Model III games' graphics, but nearly all entries used the III character set (the car in a road race game left a trail of capital B's on our PMC). Actual play, of course, isn't affected, and if you're deft at swapping CHR\$ values you can modify the programs.

To get to the point, let's begin with

the only entrant to place two games in the top 10: Chris Lampton of Hyattsville, MD, who began his letter, "First of all, I want you guys to know that it's impossible to write a game program in one line of Basic code." Chris managed, however, to do pretty well with Downhill Racer (Program Listing 1), in which you steer the letter H (for high-powered race car?) along a devilishly narrow track with the left and right arrow keys. No one's come close to the program's maximum score of 1,000.

Chris' second entry, Target Practice (Program Listing 2), is the best of the contest's shooting games. Represented by an ampersand, you make 10 passes across the bottom of the screen, using

```
10 CLS:X=746:P=998:F0R1=1T01000:PRINT@0,"SCORE ="S:S=S+1:IFPEEK(1
5360+X+64)=4200RPEEK(15360+X)=42THENPRINT@X,"H":PRINT@896,"":END
ELSEPRINT@X,"H":PRINT@P,"" **C=RND(3)-2:P=P+C:K=PEEK(14440):
IFK=32THENX=X-1:NEXTELSEIFK=64THENX=X+1:NEXTELSENEXT
20 REM DOWNHILL RACER BY CHRISTOPHER LAMPTON
30 REM 8317-14TH AVE., APT. 201, HYATTSVILLE, MD 20783
```

Program Listing 1. Downhill Racer.

```
10 FORK=1T09:CLS:PRINT@414,"+ +":F0R1=896T0959:PRINT@64,"SCORE ="S
:PRINT@I-1," ":PRINT@I,"&":IFINKEYS=" THENFORJ=1-64T0384STEP-6
4:PRINT@J+64," ":IFPEEK(15360+J)=43THENS=S-1:NEXT:NEXTELSEPRINT@J
,"":S=S-(J=415):NEXT:NEXT:NEXTELSENEXT:NEXT
20 REM TARGET PRACTICE BY CHRISTOPHER LAMPTON
30 REM 8317-14TH AVE., APT. 201, HYATTSVILLE, MD 20783
```

Program Listing 2. Target Practice.

```
10 CLS:PRINT@404,STRINGS(25,131):X=352:F0R1=1T099999:PRINT@X," ":
X=X+(RND(3)-2)*INT(L/200+1):P=PEEK(14400):X=X+SGN((P-63)*P):PRINT@
X,"":M=M+1:IFX=340ANDX<=364THENNEXTLESEPRINT@923,"YOU LOSE!":P
RINT@983,"YOUR SCORE WAS"M:F0R5=1T06:PRINT@1023," ":NEXTS
20 REM TABLE GAME BY DAN NEWMAN
30 REM 315 SPRINGDALE TERRACE, YARDLEY, PA 19067
```

Program Listing 3. Nameless Table Game.

the space bar to shoot between two plus signs centered above. Place your bullet correctly, and earn a point; hit one of the pluses, and lose one.

We can't think of a name for Dan Newman's game (Program Listing 3); Max suggests "Table Setting" or "Wind Tunnel Table," while Mercedes likes "Push Comes to Shove," except that

Twyla Tharp's already used it." Twyla Tharp, she explains, is a famous dance choreographer, adding that "dance choreographer" is redundant. The game, anyway, challenges you to use the left and right arrow keys to keep from falling off a table. The longer you last, the harder the program buffets you back and forth.

Program Listing 4 is Lawrence Corrado's Jaywalker, a mini-Frogger in which the object is to cross as many lanes of the 64-lane freeway as possible without getting hit by a speeding car. Should you make it across (the 8 and 9 keys move you left and right), you begin on the left side again, but one row closer to the bottom—so each trip across means less time to dodge oncoming traffic.

Judging from the majority of entries, Mercedes could write her Ph.D. thesis on "Vertical Scrolling as the Dominant One-Line Game Concept." Six of our 10 winners feature scrolling graphics.

Asteroid Belt (Program Listing 5) is a good example: You use the left and right arrows to guide your ship through the cluttered space lanes, surviving as long as you can. Besides being a fast-paced and nice-looking game, Tom Marshall's program has the easiest restarting procedure of any: After the inevitable crash, it briefly shows your score and then restarts automatically. In short, it runs forever. We had to drag

```
5 IFN=0CLS:N=1:GOTO5ELSEFORP=1TO10:NEXT:POKE15360+J,32:PRINT#959+R
ND(64),CHR$(143):IFPEEK(15360+J)=143CLS:PRINT#534,"Your Score:"J:F
ORP=1TO2000:NEXT:RUNELSEX=PEEK(14368):J=J+SGN(-5/2*X+3/2*X*X):POKE
15360+J,234:GOTO5
10 REM JAYWALKER BY LARRY CORRADO
20 REM 2220 MARKHAM ST., MANITOWOC, WI 54220
```

Program Listing 4. Jaywalker.

```
1 CLS:L=32:FORX=1TO1:PRINT#RND(61)+960,CHR$(174)CHR$(191)CHR$(157)
:PRINT#L,CHR$(165)CHR$(154):A=PEEK(14400):L=L+((AAND32)<>0):L=L-
(AAND64)<>0):L=ABS(L):IF(PEEK(L+15424)ORPEEK(L+15425))<>32THENCLS:
PRINTP:FORX=1TO500:NEXT:RUNELSEP=P+1:X=0:NEXT
10 REM ASTEROID BELT BY TOM MARSHALL
20 REM 1217 N. UNION ST., KENNEWICK, WA 99336
```

Program Listing 5. Asteroid Belt.

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Max away from it after nine hours.

Another sophisticated scroller is Curve Hugger (Program Listing 6), a road race created by Roberto Salgado Jr. of Valley Cottage, NY. Curve Hugger throws a series of different tracks, curves, and surrounding landscapes at left-and-right-arrow drivers; the number displayed after you crash shows how many courses you completed. Track 1 is usually long and straight, to lull you into a false sense of security. By track 11 or 12, though, it's the Monte Carlo esses at 200 mph. A year of driving the Cafe van let me reach track 17.

Lunar Lander in one line, you ask? Ask Keith Voss of Orlando, FL, whose Crash Lander (Program Listing 7) puts you at the helm of an excursion module plummeting toward a tiny landing pad. The arrow keys control lateral move-

ment and thrust, but exceed the time limit and you're left hanging in midair.

Then there's Dean Thompson's wacky Conga Line (Program Listing 8), which uses the Model III's frowning-face symbol to show five unhappy spies dancing through a minefield. The left and right arrows let the spies follow the leader, swerving like an Ice Capades chorus.

As successive leaders step on mines (with sound for the explosions), desperate spies may want to try the left/right wraparound. Incidentally, Dean warns, the density of the minefield increases every 2,000 points. He claims a personal record of 5,600; Max, stuck at 4,625, says, "I'm dancing as fast as I can."

Bill Peters of Salt Lake City, UT, wrote probably the best non-scrolling game, his twisty and original Snake-

around (Program Listing 9). The object is to survive for as long as possible by using the arrow keys (in the four primary directions or diagonal combinations) to grow, while avoiding your own trail and ever-multiplying obstacles. You have wraparound in all four directions. You'll need it to beat Bill's score of 541.

Our favorite one-liner, though, combines scrolling and Model III graphics with the Centipede theme: Steve Davis of Houston, TX, wins the First (Annual? Ever?) Cafe Espresso Contest and a year's subscription to 80 Micro for Chilopod (Program Listing 10).

Your chilopod moves diagonally right, unless you press the left arrow key to steer left; your goal is to stay on the garden path and devour tasty flies. As you snack away—and zigzagging to pick up flies takes practice—you'll be obliged to dodge mushrooms, which get bigger and more plentiful as you go along. A bonus chilopod is awarded every 1,000 points, but the only way to get points is to eat flies.

```
10 CLS:OUT236,0:P=15890:FORK=1TO20:D=K/10+1:Q=171+K:J=RND(3)*6:FOR
X=0TO6.2STEPK/100:I=PEEK(15168):POKEP,238:C=SIN(X)*J+19:PRINT#960,
STRING$(C,Q)TAB(C+J)STRING$(5,Q):IFPEEK(P)=QPRINTELSEPOKEP-64,2:I
FI=32P=P-D:NEXTX,KELSEIFI=64P=P+D:NEXTX,KELSENEXTX,K
20 REM CURVE HUGGER BY ROBERTO SALGADO, JR.
30 REM 26 CONNECTICUT COURT, VALLEY COTTAGE, NY 10989
```

Program Listing 6. Curve Hugger.

```
10 CLS:FORK=0TO9:READD(X):NEXTX=X+15390:PRINTCHR$(23):POKEP+930+RND
(31)*2,131:FORZ=1TO40:P=PEEK(14400):FORY=1TO20:NEXT:POKEP,32:X=X+D
(P/8):IFPEEK(X)=131PRINT"YEA!"ELSEIFX>16319:X=X-960:NEXTELSEPOKEP,
5:NEXT:PRINT"TIME":DATA64,0,64,64,62,-2,64,64,66,2
20 REM CRASH LANDER BY KEITH VOSS
30 REM 2400 S. SUMMERLIN, ORLANDO, FL 32806
```

Program Listing 7. Crash Lander.

```
1 A=255:FORI=2TOS/2000:POKE16316+RND(16)*4,194:NEXT:OUTA,0:PRINT#
960,"":E=PEEK(P)<194:POKEP,197:PRINT#2,S:K=PEEK(14400):OUTA,2:P=
15616+64*M+(63ANDP)-4*(K=64)+4*(K=32):S=S+5:IFETHENELSEFOR=1TO5:
OUTA,2:POKEP-I,92:POKEP+I,47:OUTA,1:NEXT:M=M-1:IFM+5THEN1
10 REM CONGA LINE BY DEAN S. THOMPSON
20 REM 133 BROOKSHIRE LANE, WILMINGTON, NC 28403
```

Program Listing 8. Conga Line.

```
10 N=128:F=16:X=64:Y=24:CLS:FORF=1TON*N:SET(RND(127),RND(47)):A=(P
EEK(14400)AND120)/4:P=-(A=0)*F+A:D=FAND6:C=(FAND24)/4:X=X+C+3*(C>0
):Y=Y+D+3*(D>0):X=X+N*(X>N)-(X<0):Y=Y+48*(Y>47)-(Y<0):IFPOINT
(X,Y)CLS:PRINT"SCORE:"PELSESET(X,Y):P=P+1:NEXTT
20 REM SNAKEAROUND BY BILL PETERS
30 REM 2470 CAMELBACK ROAD, SALT LAKE CITY, UT 84121
```

Program Listing 9. Snakearound.

```
0 T=SGN(RND(R+1)-1):PRINT#960,CHR$(191)TAB(RND(60-R))CHR$(137+5*T)
STRING$(R,191*T)CHR$(134+7*T)TAB(63)CHR$(191)@P+416,CHR$(174)CHR$(
191)CHR$(157)@0,S,M:P=P-SGN(PEEK(14420)-3)*2:A=PEEK(P+15841):R=R+
.01:M=INT(S/1000)-D:IFA<141S=A+32:GOTOELSEDD+1:IFM>0GOTO
10 REM CHILOPOD BY STEVE DAVIS
20 REM 15726 DIANA LANE, HOUSTON, TX 77062
```

Program Listing 10. Chilopod.

"Mad Max gallantly volunteered to set the record."

The one-key control is elegantly simple; the increasing difficulty and bonus features are remarkable for a 1/4K program. Best of all, though, Chilopod requires you to hit targets as well as avoid obstacles. Since Steve didn't send an author's score, Mad Max gallantly volunteered to set the record; he insists his 3,399 is only the beginning, but it's been a week and 80 Micro says they can't hold the issue deadline any longer.

We'd like to thank everyone who entered, and congratulate many people on remarkable feats of programming. (Using line number 0, to save a byte by writing GOTO without a number, was only the beginning for most entrants.) We were considering a two-line games contest for next year, but frankly, after this batch, we're afraid to think what we'd get. ■

—R.G.

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Rules

1. Final entries must be in by November 1, 1983.
2. All entries must be submitted in a 10x13" envelope and must include: typewritten, double-spaced documentation; a printed copy of the program listing; a magnetic disk or cassette containing the program listing, the documentation, and any figures or tables; and a completed entry blank.
3. Documentation should consist of an explanation of the program, its purpose, how to use it, and the necessary software and hardware needed to use it (including memory re-

quirements). Good documentation also points out the interesting algorithms and program techniques used without giving a line-by-line account.

4. Entries must be original and unpublished.

5. All winning programs become the property of **80 Micro**.

6. The category in which you will be judged will be determined by your age as of November 1, 1983. You must not have turned 19 by that date.

7. You may submit as many entries as you like, however, each one must be submitted separately and must have all of the information and materials stated above.

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State/Zip _____ Phone _____

Machine (circle one)

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Color Computer Pocket Computer Other _____

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Animate Objects

by Richard Ramella

Let's grow a tree, test probability, and learn a tricky two-person game, all using computer animation.

These three programs have separate listings for Level II and Color Basic, so always check the listing's first line to make sure you're keying in a program that fits your computer.

Tree uses random Set(X,Y) graphics to grow a little tree on your screen. Probability Triangle gives a picture of probability at work. The Fourth Power is a two-person strategy

game in which the computer provides playing field and pieces, and recognizes winning positions.

Tree and Probability Triangle are quite similar in both versions, but The Fourth Power called for a completely different approach in each version, so the two listings of the same program are hardly alike.

Tree

November might seem a strange time to grow a tree. The Level II listing generates a plain

old tree, but the Color Basic program makes an orange tree. You'll see what I mean.

I won't get too technical here, but the idea of probability involved in this program was first formed by a famous French mathematician and philosopher named Blaise Pascal (1623-1662), a genius who figured out the betting odds for a friend who gambled.

Much later, Sir Francis Galton (1822-1911), an English scientist, got the idea of showing Pascal's Triangle as a moving demonstration of probability. That led to the Galton Board, which the program Probability Triangle simulates quite nicely.

The Level II version has 13 bins at the bottom. Instead of balls bouncing left and right, imagine what your chances are of tossing 13 straight heads in a coin flip.

Then you'll see why it's prob-

```
100 REM * TREE * TRS-80 LEVEL II BASIC
110 REM * FUN HOUSE / NOV. '83 / RICHARD RAMELLA
120 CLS
130 X=63
140 FOR Y=47 TO 42 STEP -1
150 SET(X,Y)
160 NEXT
170 Y=40
180 GOTO 200
190 Y=A
200 FOR X=0 TO 126
210 IF POINT(X,Y)=-1 AND POINT(X,Y-1)=0 THEN N=10: GOSUB 260
220 NEXT X
230 IF N=10 THEN N=0: GOTO 190
240 Y=Y+1
250 GOTO 200
260 Z=X
270 T=X
280 FOR A=Y TO Y-RND(5) STEP -1
290 SET(Z,A)
300 SET(T,A)
310 T=T-RND(20)/10
320 Z=Z+RND(20)/10
330 IF A=2 THEN PRINT @ 448,"THERE'S YOUR TREE";: GOTO 330
340 NEXT A
350 RETURN
360 END
```

Tree—Level II.

The Key Box

Model I and III
Color Computer
4K RAM
Cassette or Disk Basic
Color Basic

able that a fairly equal number of heads and tails would bring the coin to the middle of the range of possibilities most of the time. This program is also fun to watch.

The Color Basic program has shallower bins than the Level II listing. In both programs, the balls stop when a bin fills up. Then you'll see the shape of probability drawn according to the random way the balls have fallen.

After you key in the program, type RUN and press the enter key. The tree grows upward, and when it's complete, a message to that effect appears on the screen.

What makes the program interesting is how the Point command searches X,Y coordinates on the screen. When it finds the end of a branch, the program grows two new branches from it.

Probability Triangle

This program draws a triangular set of dots with a set of bins at the bottom. Time after time, a little ball appears atop the first bumper at the top of the triangle. That ball can bounce to either the left or right. And so it goes down through the triangle until it falls into a bin.

You might think the bins at the bottom would fill up at about the same rate. It turns out they don't. As you watch, the collection of balls in the bins begins to form a bell shape because it's more likely the ball will fall toward the middle than to either side.

The Fourth Power

Last we come to a program

```
100 REM * TREE * TRS-80 COLOR BASIC
110 REM * FUN HOUSE / NOV. '83 / RICHARD RAMELLA
120 CLS(0)
130 X=31
140 FOR Y=31 TO 28 STEP -1
150 SET(X,Y,1)
160 NEXT
170 Y=26
180 GOTO 200
190 Y=A
200 FOR X=0 TO 62
210 IF POINT(X,Y)<>0 AND POINT(X,Y-1)=0 THEN N=10: GOSUB 260
220 NEXT X
230 IF N=10 THEN N=0: GOTO 190
240 Y=Y+1
250 GOTO 200
260 Z=X
270 T=X
280 FOR A=Y TO Y-RND(5) STEP -1
290 J=RND(5)
300 K=RND(5)
310 IF J=1 THEN H=8 ELSE H=1
320 IF K=1 THEN L=8 ELSE L=1
330 SET(Z,A,H)
340 SET(T,A,L)
350 T=T-RND(15)/10
360 Z=Z+RND(15)/10
370 IF A=2 THEN PRINT @ 448,"ORANGE TREE";: GOTO 370
380 NEXT A
390 RETURN
400 END
```

Tree—Color Basic.

```
100 REM * PROBABILITY TRIANGLE * TRS-80 LEVEL II BASIC
110 REM * FUN HOUSE / NOV. '83 / RICHARD RAMELLA
120 CLS
130 PRINT "PROBABILITY"
140 PRINT @ 128,"TRIANGLE"
150 SET(62,3)
160 FOR Y=3 TO 19 STEP 2
170 FOR X=44 TO 80
180 IF POINT(X,Y)=1 THEN SET(X-2,Y+2): SET(X+2,Y+2)
190 NEXT X
200 NEXT Y
210 X=64
220 FOR Y=1 TO 21 STEP 2
230 SET(X,Y)
240 X=X+2
250 NEXT Y
260 FOR X=38 TO 92 STEP 4
270 FOR Y=23 TO 46
280 SET(X,Y)
290 NEXT Y
300 NEXT X
310 Y=47
320 FOR X=38 TO 90
330 SET(X,Y)
340 NEXT X
350 X=64
360 Y=0
370 SET(X,Y)
380 IF Y<23 THEN FOR T=1 TO 10 ELSE FOR T=1 TO 1
390 NEXT T
400 RESET(X,Y)
410 IF POINT(X,Y+1)=0 THEN Y=Y+1: GOTO 370
420 IF Y>22 THEN 470
430 RANDOM
440 A=RND(2)
450 IF A=1 THEN X=X+2 ELSE X=X-2
460 GOTO 370
470 SET(X,Y)
480 IF POINT(X,Y+1)=0 THEN RESET(X,Y): Y=Y+1: GOTO 470
490 IF POINT(X-1,Y+1)=1 AND POINT(X+1,Y+1)=1 GOTO 530
500 RESET(X,Y)
510 IF POINT(X-1,Y+1)=0 THEN X=X-1 ELSE X=X+1
520 GOTO 470
530 IF Y=23 AND POINT(X-1,24)=1 AND POINT(X+1,24)=1 GOTO 530 ELSE
540 END
```

Probability Triangle—Level II.

```

100 REM * PROBABILITY TRIANGLE * TRS-80 COLOR BASIC
110 REM * FUN HOUSE / NOV. '83 / RICHARD RAMELLA
120 CLS(0)
130 N=2
140 A$="PROBABILITY"
150 B$="TRIANGLE"
160 B=1
170 FOR A=96 TO 416 STEP 32
180 PRINT @ A,MID$(A$,B,1);" ";
190 PRINT @ A+30,MID$(B$,B,1);" ";
200 B=B+1
210 NEXT A
220 SET(31,3,8)
230 FOR Y=3 TO 15 STEP 2
240 FOR X=18 TO 44
250 IF POINT(X,Y)=8 THEN SET(X-2,Y+2,8): SET(X+2,Y+2,8)
260 NEXT X
270 NEXT Y
280 X=33
290 FOR Y=1 TO 17 STEP 2
300 SET(X,Y,8)
310 X=X+2
320 NEXT Y
330 FOR X=11 TO 58 STEP 4
340 FOR Y=19 TO 31
350 SET(X,Y,8)
360 NEXT Y
370 NEXT X
380 Y=31
390 FOR X=11 TO 54
400 SET(X,Y,8)
410 NEXT X
420 X=33
430 Y=0
440 SET(X,Y,8)
450 N=N+1
460 IF N/3=INT(N/3) THEN SOUND 220-(Y+X),1
470 RESET(X,Y)
480 IF POINT(X,Y+1)=0 THEN Y=Y+1: GOTO 440
490 IF Y>18 THEN 530
500 A=RN(2)
510 IF A=1 THEN X=X+2 ELSE X=X-2
520 GOTO 440
530 SET(X,Y,8)
540 IF POINT(X,Y+1)=0 THEN RESET(X,Y): Y=Y+1: GOTO 530
550 IF POINT(X-1,Y+1)=8 AND POINT(X+1,Y+1)=8 GOTO 590
560 RESET(X,Y)
570 IF POINT(X-1,Y+1)=0 THEN X=X-1 ELSE X=X+1
580 GOTO 530
590 IF Y=19 AND POINT(X-1,20)=8 AND POINT(X+1,20)=8 GOTO 590 ELSE 420
600 END

```

Probability Triangle—Color Basic.

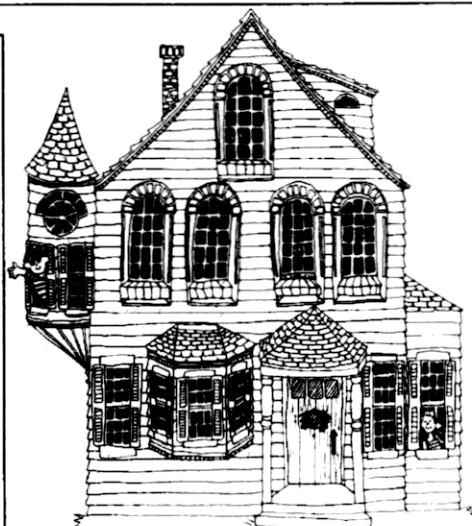
The Fourth Power—Level II.

```

100 REM * THE FOURTH POWER * TRS-80 LEVEL II BASIC
110 REM * FUN HOUSE / NOV. '83 / RICHARD RAMELLA
120 CLS
130 CLEAR 500
140 DEFSTR A-J,L,R
150 DIM M(21),N(12),P(12)
160 DATA 65,74,83,193,202,211,321,330,339,449,458,467,577,586,595,
705,714,723,833,842,851
170 DATA 65,74,83,193,202,211,321,330,339,449,458,467
180 DATA 449,458,467,577,586,595,705,714,723,833,842,851
190 FOR Z=1 TO 21
200 READ M(Z)
210 NEXT
220 FOR Z=1 TO 12
230 READ N(Z)
240 NEXT Z
250 FOR Z=1 TO 12
260 READ P(Z)
270 NEXT Z
280 K=15360
290 J=CHR$(32)
300 A(1)=J+"OOOOOO"+J
310 A(2)=J+"XXXXXX"+J
320 L="L"

```

Listing continued



that makes sure Fun House is really fun this month.

The Fourth Power is a grid strategy game that's simple to play. The playing field has room for 42 playing pieces—seven down and six across. Two players take turns dropping their pieces down vertical rows as far as they will go.

The winner is the player who first gets four of his or her pieces in a row, either vertically, horizontally, or diagonally.

In both program versions, each player first enters his or her name. In the CoCo version, one player has orange playing pieces and the other has blue. In the Level II version, one player has OOOOOO pieces and the other has XXXXXX pieces.

At the start of each player's turn, his playing piece appears at the top left of the screen. In both versions, a player moves his piece left and right until coming to the vertical row in which he makes his play.

Then, a one-key command drops the piece down that row, and it stops only if it comes to the bottom of the row or if another piece is below it.

In the CoCo version, move the playing piece from side to side

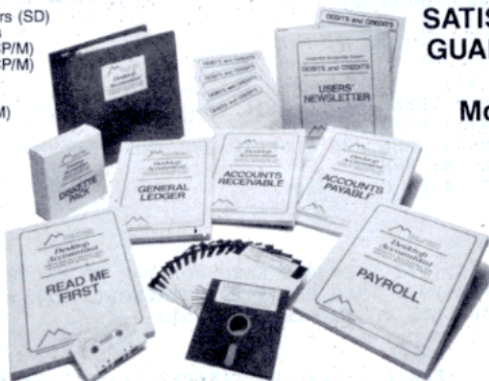
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(manufacturing company) San Antonio, Texas

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ACCOUNTS RECEIVABLE provides instant, on-line customer account information (both current and aged), with complete, timely invoicing, including open-item (or balance forward) and statement capabilities. It makes the entire billing process fast, easy, and efficient. It quickly identifies your overdue accounts, helps speed collections, helps control your cash flow, and assists you in making better financial decisions. Both detailed and summary customer activity and aging reports are instantly available • Preprinted forms available for invoices and statements • Detailed audit trail • Maintains comprehensive customer data files • Produces 8 reports and documents • Includes automatic periodic customer/client billing option which is ideal for service businesses • Itemized monthly transactions • Master File capacity: 400 Customers • Monthly Transactions capacity: 800 with 200K diskette; 3,500 with 500K diskette; 7,000 per Megabyte with a Hard Disk.

ACCOUNTS PAYABLE maintains complete vendor/voucher history and includes check-writing capabilities. Current and aged payable reports are available upon command. It prepares an extremely useful cash flow/cash requirements report that greatly improves management control of your most valuable resource—cash! It prints checks (on commercially available forms on which your company name, address and logo can be imprinted) with comprehensive check stubs that your vendors will appreciate • Produces 11 reports and documents • Automatic pay selection program allows payment by due date or by discount date • Manual and automatic checkwriting • Check register • Detailed audit trail • Itemized monthly transactions • Master File capacity: 400 Vendors • Monthly Transactions capacity: 800 with 200K diskette; 3,500 with 500K diskette; 7,000 per Megabyte with a Hard Disk.

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Accounts Receivable 1. Daily Transactions Report 2. Invoices (with or without preprinted forms) 3. Statements (with or without pre-printed forms) 4. Summary Aging Report 5. Detailed Aging Report 6. Itemized Monthly Transactions 7. Detailed Customer Activity Report 8. Summary Customer Account Report

Accounts Payable 1. Daily Voucher Report 2. Daily Credit Report 3. Checks with Detailed stubs 4. Check Register 5. General Ledger Transfer Report 6. Cash Requirements Report 7. Transaction Register 8. Open Voucher Report 9. Aged Payables Report 10. Detailed Vendor Activity Report 11. Summary Vendor Account Report

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Listing continued

```
330 R="R"
340 INPUT "PLAYER ONE (000000)";B(1)
350 INPUT "PLAYER TWO (XXXXXX)";B(2)
360 CLS
370 PRINT @ 960,STRING$(54,191);
380 FOR X=1 TO 2
390 M=0
400 B=INKEY$
410 PRINT @ M,A(X);
420 IF B=L AND M=0 THEN 400 ELSE IF B=L THEN FOR N=M TO M-9 STEP -
1: PRINT @ N,A(X);: NEXT N: M=M-9
430 IF B=R AND M=45 THEN 400 ELSE IF B=R THEN FOR N=M TO M+9: PRIN
T @ N,A(X);: NEXT N: M=M+9
440 IF B="D" GOTO 480: GOTO 460
450 GOTO 400
460 NEXT X
470 GOTO 380
480 IF PEEK(K+M+65)<>32 THEN 400 ELSE FOR P=M TO M+896 STEP 64
490 IF PEEK(K+P+129)=32 THEN PRINT @ P,STRING$(9,32);: PRINT @ P+6
4,A(X);: GOTO 500 ELSE GOSUB 520: GOTO 510
500 NEXT P
510 GOTO 460
520 Z=PEEK(K+P+1)+PEEK(K+P+129)+PEEK(K+P+257)+PEEK(K+P+385)
530 IF Z=316 OR Z=352 GOTO 680
540 Z=0
550 FOR Q=1 TO 21
560 Z=PEEK(K+M(Q))+PEEK(K+M(Q)+9)+PEEK(K+M(Q)+18)+PEEK(K+M(Q)+27)
570 IF Z=316 OR Z=352 GOTO 680
580 NEXT Q
590 FOR Q=1 TO 12
600 Z=PEEK(K+N(Q))+PEEK(K+N(Q)+137)+PEEK(K+N(Q)+274)+PEEK(K+N(Q)+4
11)
610 IF Z=316 OR Z=352 GOTO 680
620 NEXT Q
630 FOR Q=1 TO 12
640 Z=PEEK(K+P(Q))+PEEK(K+P(Q)-119)+PEEK(K+P(Q)-238)+PEEK(K+P(Q)-3
57)
650 IF Z=316 OR Z=352 GOTO 680
660 NEXT Q
670 RETURN
680 IF Z=316 THEN C=B(1) ELSE C=B(2)
690 PRINT @ 0,C" WINS.": GOTO 690
700 END
```

The Fourth Power—Color Basic.

```
100 REM * THE FOURTH POWER * TRS-80 COLOR BASIC 4K
110 REM * FUN HOUSE / NOV. '83 / RICHARD RAMELLA
120 CLS(0)
130 INPUT "FIRST PLAYER (ORANGE)";B$(1)
140 INPUT "SECOND PLAYER (BLUE)";B$(2)
150 CLS(0)
160 B$=CHR$(128)
170 FOR A=481 TO 509
180 PRINT @ A,CHR$(207);
190 NEXT
200 E$=CHR$(255)
210 F$=CHR$(175)
220 A$(1)=B$+E$+E$+E$+E$+B$
230 A$(2)=B$+F$+F$+F$+F$+B$
240 L$=CHR$(8)
250 R$=CHR$(9)
260 D$=CHR$(10)
270 A(1)=8
280 A(2)=3
290 FOR C=1 TO 2
300 B=0
310 X=2
320 Y=2
330 GOSUB 490
340 Z$=INKEY$
350 IF TIMER/20=INT(TIMER/20) THEN SOUND RND(13)*18,1
360 IF Z$=L$ AND B=0 THEN 340 ELSE IF Z$=L$ THEN FOR B=B TO B-5
STEP -1: GOSUB 490: X=X-2: NEXT B: B=B+1: X=X+2
370 IF Z$=R$ AND B>24 THEN 340 ELSE IF Z$=R$ THEN FOR B=B TO B+5
: GOSUB 490: X=X+2: NEXT B: B=B-1: X=X-2
380 IF Z$=D$ AND POINT(X,3)<>0 THEN 340
390 IF Z$=D$ GOSUB 420: GOSUB 520 ELSE GOTO 340
400 NEXT C
410 GOTO 290
```

Listing continued



Continued from p. 302

by tapping the left- and right-arrow keys, and drop it down the row by pressing the down-arrow key. In the Level II version, move the piece sideways by pressing L for left or R for right, and drop the piece into the row by tapping D for drop.

Both versions recognize a winning position and announce the winner's name. The CoCo version chains together the winning row of four pieces, but the Level II version does not.

Be patient as you play. It takes the CoCo five seconds and the Level II four seconds to check for winning positions. During this time the game is frozen, but when the check is complete, the next player's

Listing continued

```

420 FOR B=B TO B+480 STEP 32
430 PRINT @ B,AS(C);
440 SOUND RND(13)*18,1
450 IF POINT(X,Y+2)<>0 THEN RETURN
460 PRINT @ B+1,STRING$(4,128);
470 Y=Y+2
480 NEXT B
490 PRINT @ B,AS(C);
500 SOUND RND(13)*18,1
510 RETURN
520 FOR D=2 TO 26 STEP 4
530 FOR E=2 TO 22 STEP 10
540 IF POINT(E,D)=A(C) AND POINT(E+10,D)=A(C) AND POINT(E+20,D)=
A(C) AND POINT(E+30,D)=A(C) THEN FOR F=E TO E+30: SET(F,D,A(C)):
NEXT: GOTO 730
550 NEXT E
560 NEXT D
570 FOR D=2 TO 14 STEP 4
580 FOR E=2 TO 52 STEP 10
590 IF POINT(E,D)=A(C) AND POINT(E,D+4)=A(C) AND POINT(E,D+8)=A(
C) AND POINT(E,D+12)=A(C) THEN FOR F=D TO D+12: SET(E+4,F,A(C)):
NEXT: GOTO 730
600 NEXT E
610 NEXT D

620 FOR D=2 TO 14 STEP 4
630 FOR E=2 TO 22 STEP 10
640 IF POINT(E,D)=A(C) AND POINT(E+10,D+4)=A(C) AND POINT(E+20,D
+8)=A(C) AND POINT(E+30,D+12)=A(C) THEN FOR G=E+8 TO E+28 STEP 1
0: SET(G,D+1,A(C)): SET(G+1,D+3,A(C)): D=D+4: NEXT G: GOTO 730
650 NEXT E
660 NEXT D
670 FOR D=14 TO 26 STEP 4
680 FOR E=2 TO 22 STEP 10
690 IF POINT(E,D)=A(C) AND POINT(E+10,D-4)=A(C) AND POINT(E+20,D
-8)=A(C) AND POINT(E+30,D-12)=A(C) THEN FOR G=E+8 TO E+28 STEP 1
0: SET(G,D-1,A(C)): SET(G+1,D-2,A(C)): D=D-4: NEXT G: GOTO 730
700 NEXT E
710 NEXT D
720 RETURN
730 PRINT @ 0,"WINNER: "B$(C); " "; SOUND RND(13)*9,1: GOTO 730
740 END

```

piece appears at top left or the program announces a winner.

Next month is December, and all the computer magazines of the world will be running

programs of Christmas trees, holly wreaths, and fireplaces with stockings. But not the Fun House. I'll have something else festive. ■

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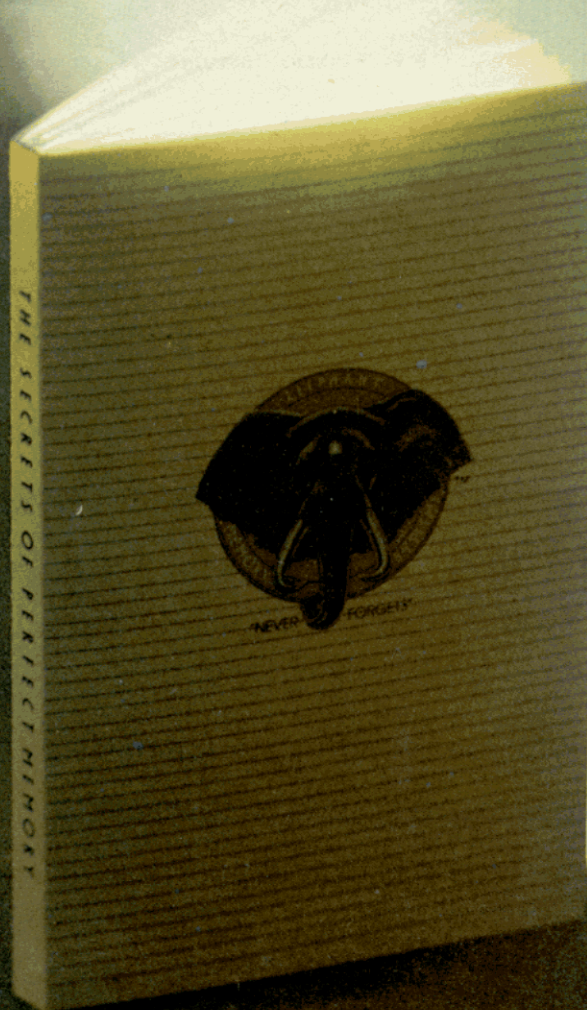
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32 VISICALC WORKSHEETS—by Ted Lewis. Expand your VisiCalc horizons with these versatile worksheets. Thirty-two different programs include games and novelties, business and household applications, statistical analysis, and "what-if" models. Everything from tic-tac-toe to depreciation scheduling, from daily carbohydrate intake to installment payments. Two appendices cover VisiCalc commands and functions. The fully documented programs are ready to be typed into your computer. A valuable resource for any VisiCalc user. BK1286 19.95

SO YOU ARE THINKING ABOUT A SMALL BUSINESS COMPUTER—By Richard G. Canning and Nancy C. Leeper. For a well-organized manual on the process of selecting the right computer system for your small business, this text can't be excelled. Designed to introduce the novice in data and word processing to the real benefits of computerization, the book is filled with money- and time-saving tips, photos of equipment, lists of suppliers, prices, explanations of computer terminology, and helpful references to additional sources of information. Everyone contemplating a first computer installation should have this book. BK1222 \$14.00*

THE CUSTOM TRS-80 AND OTHER MYSTERIES—by Dennis Kitz. More than 300 pages of TRS-80 customizing information. With this book you'll be able to explore your computer like never before. Want to turn an 8 track into a mass storage unit? Individual reverse characters? Replace the BASIC ROMs? Make Music? High speed, reverse video, Level I and Level II? Fix it if it breaks down? All this and much, much more. Even if you have never used a soldering iron or read a circuit diagram, this book will teach you how! This is the definitive guide to customizing your 80! BK1218 \$29.95.*

PROGRAMMING • 6809

6809 MICROCOMPUTER PROGRAMMING AND INTERFACING—by Andrew C. Staugaard, Jr. Getting involved with Tandy's new Color Computer? If so, this new book from the Blackburn Group will allow you to exploit the awesome power of the machine's 6809 microprocessor. Detailed information on processor architecture, addressing modes, register operation, data movement, arithmetic logic operations, I/O and interfacing is provided, as well as a review section at the end of each chapter. Four appendices are included covering the 6809 instruction set, specification sheets of the 6809 family of processors, other 6800 series equipment and the 6809/6821 Peripheral Interface Adapter. This book is a must for the serious Color Computer owner. BK1215 \$13.95.*

INSIDE LEVEL II—For machine language programmers. This is a comprehensive reference guide to the Level II ROMs, allowing easy utilization of the sophisticated routines they contain. It concisely explains set-ups, calling sequences, variable passage and I/O routines. Part II presents an entirely new composite program structure which unloads under the SYSTEM command and executes in both BASIC and machine code with the speed and efficiency of a compiler. Special consideration is given to disk systems. BK1183 \$15.95.*

TRS-80 EXTENDED COLOR BASIC—by Richard Haskell. This is a complete guide to programming the TRS-80 Color Computer in BASIC, with step-by-step instructions and lots of screen photographs. Good for beginning and advanced programmers, this book includes sample programs and information on using the keyboard, cassette tapes, graphics, sound effects, and more. Richard Haskell is also the author of *Apple BASIC* and *PET/IBM BASIC*. BK1285 12.95

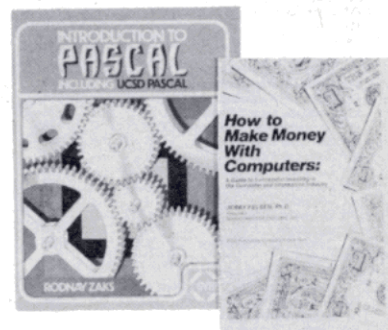
PROGRAMMING THE Z-80—by Rodney Zaks. Here is assembly language programming for the Z-80 presented as a progressive, step-by-step course. This book is both an educational text and a self-contained reference book, useful to both the beginning and the experienced programmer who wish to learn about the Z-80. Exercises to test the reader are included. BK1122 \$16.95*

ASSEMBLY LANGUAGE GRAPHICS FOR THE TRS-80 COLOR COMPUTER—by Don Inman and Kurt Inman with DYMAX. This dynamic new book uses sound and graphics to show you how 6809 assembly language can be used to perform tasks that would be difficult or impossible with BASIC. All of the techniques are explained in a hands-on approach. Learn how to tailor your own programming style, from editing, assembling, executing and even debugging, to making your own programs run quickly and efficiently. It is also packed with video screen diagrams which explain each step of the process of creating your own graphics. BK1277 \$??.*

TRS-80 COLOR BASIC—Bob Albrecht. Learn how to use the unique color, sound and graphics of the TRS-80 Color Computer. This self-teaching guide uses a learn-as-you-play format to teach Color BASIC. Packed with games, experiments, programming problems, and solutions, it is an ideal introduction for children, teachers, and adults. It starts with simple concepts and takes you on to more complicated games, graphics, and activities, including many chances for you to try out your newly learned programming skills. Included is an entire chapter on programming problems, which offers tip on adapting to Microsoft BASIC on other personal computers. BK1280 \$10.95

BASIC & PASCAL

INTRODUCTION TO PASCAL—By Rodney Zaks. A step-by-step introduction for anyone wanting to learn the language quickly and completely. Each concept is explained simply and in a logical order. All features of the language are presented in a clear, easy-to-understand format with exercises to test the reader at the end of each chapter. It describes both standard PASCAL and UCSD PASCAL, the most widely used dialect for small computers. No computer or programming experience is necessary. BK1189 \$16.95



HOW TO MAKE MONEY WITH COMPUTERS—In 10 information-packed chapters, Jerry Felsen describes more than 30 computer-related, money-making, high profit, low capital investment opportunities. BK1003 \$15.00.*

PROGRAMMING IN PASCAL—by Peter Grogono. The computer programming language PASCAL was the first language to embody in a coherent way the concepts of structured programming, which has been defined by Edsger Dijkstra and C.A.R. Hoare. As such, it is a landmark in the development of programming languages. PASCAL was developed by Niklaus Wirth in Zurich; it is derived from the language ALGOL 60 but is more powerful and easier to use. PASCAL is now widely accepted as a useful language that can be efficiently implemented, and as an excellent teaching tool. It does not assume knowledge of any other programming language and therefore suitable for an introductory course. BK1140 \$12.95.*

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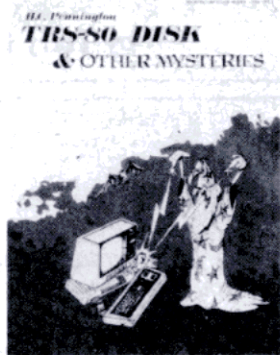
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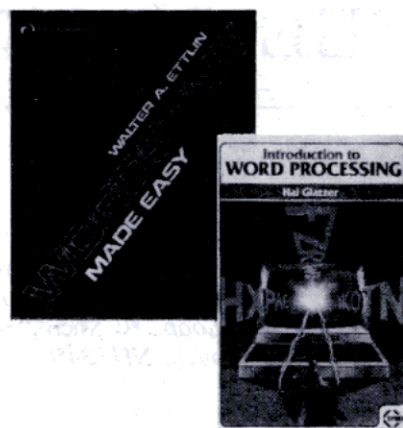
A USER GUIDE TO THE UNIX SYSTEM by Jean Yates and Rebecca Thomas. Here at last is a clearly written book that allows you to use the Unix operating system easily, and at a fraction of the time it previously took. If you're using, evaluating or simply curious about this system, this is your book. BK1242 \$15.99

CAPTAIN 80 BOOK OF BASIC ADVENTURES—by Robert Liddell. This book contains 18 of the most popular Adventure programs available today, all in one easy to read book with listings ready to be keyed in to your computer. This unique book also contains an ADVENTURE GENERATOR program, not available from any other source. This generator program will actually write another BASIC ADVENTURE PROGRAM! Although specifically written for the TRS-80 Model I & III, these programs are adaptable to other computers using Microsoft BASIC. BK 1240 \$19.95

80 micro BOOK SHELF

TRS-80 DISK AND OTHER MYSTERIES—by Harvard C. Pennington. This is the definitive work on the TRS-80 Model I disk system. It is full of detailed "How to" information with examples, samples and in-depth explanations suitable for beginners and professionals alike. The recovery of one lost file is worth the price alone. BK1181 \$22.50.

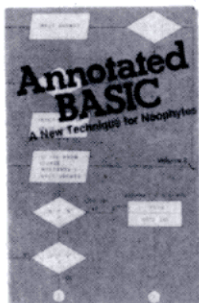
MASTERING CP/M—by Alan R. Miller. For advanced CP/M users or systems programmers who want maximum use of the CP/M operating system, this book takes up where the *CP/M Handbook* leaves off. It will give you an in-depth understanding of the CP/M modules such as CCP (Console Command Processor), BIOS (Basic Input/Output System), and BDOS (Basic Disk Operating System). It explains the incorporation of additional peripherals to the system, console I/O, the use of the file control block and much more. It also includes a library of useful macros and a comprehensive set of appendices. BK1263 \$16.95



INTRODUCTION TO WORD PROCESSING by Hal Glatzer. This book explains in plain language what a word processor can do, how to use one, how it improves productivity—especially in businesses that handle lots of words—and how to buy one wisely. No technical knowledge required, for all first-time users and those considering purchasing a word processor. BK1238 \$12.95

WORDSTAR MADE EASY by Walter A. Ettlin. Now WordStar is as simple to learn as it is easy to use. This book teaches WordStar in 14 easy lessons, saving hours of hard work. It comes with a convenient pull-out Command Card. BK1239 \$7.95

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COMPUTER CARNIVAL—by Richard Ramella. Your child can become a crackerjack computerist with the sixty TRS-80 Level II programs in *COMPUTER CARNIVAL*. This large-type, spiral bound book for beginners is a veritable funhouse of games, graphics, quizzes and puzzles. Written by 80 Micro columnist Richard Ramella, the programs are challenging enough to ensure continued learning, yet short enough to provide your child with the immediate delight and reward of mastering basic computing skills. And for even greater enjoyment, get the *CARNIVAL COMPANION*, a 30-minute cassette containing all the programs in the book. Eliminates tiresome typing and lets your child spend more time enjoying the programs. BK7389 \$16.97 CC7389 Book and Cassette \$24.97

40 COMPUTER GAMES FROM KILOBAUD MICROCOMPUTING—Forty games in all in nine different categories. Games for large and small systems, and even a section on calculator games. Many versions of BASIC used and a wide variety of systems represented. A must for the serious computer gamesman. BK7381 \$7.95.

THE SELECTRIC INTERFACE—by George Young. You need the quality print that a daisy wheel printer provides but the thought of buying one makes your wallet wilt. *SELECTRIC INTERFACE*, a step-by-step guide to interfacing an IBM Selectric I/O Writer to your microcomputer, will give you that quality at a fraction of the price. George Young, co-author of *Kilobaud Microcomputing* magazine's popular "Kilobaud Klassroom" series, offers a low-cost alternative to buying a daisy wheel printer. *SELECTRIC INTERFACE* includes: step-by-step instructions, tips on purchasing a used Selectric, information on various Selectric models, including the 2740, 2980, and Dura 1041, driver software for 280, 8080, and 6502 chips, tips on interfacing techniques. With *SELECTRIC INTERFACE* and some background in electronics, you can have a high-quality, low-cost, letter-quality printer. Petals not included. BK7388 (125 pages) \$12.97

ANNOTATED BASIC—A NEW TECHNIQUE FOR NEO-PHYTES—BASIC programming was supposed to be simple—a beginner's programming language which was so near to English that it could be easily understood. But, in recent years, BASIC has become much more powerful and therefore much more difficult to read and understand. BASIC simply isn't basic anymore.

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Annotated BASIC deals with the hows and whys of TRS-80 BASIC programming. How is a program put together? Why is it written that way? By observing the programs and following the annotation, you can develop new techniques to use in your own programs—or modify commercial programs for your specific use. *Annotated BASIC Volume 1* BK7384 \$10.95 *Annotated BASIC Volume 2* BK7385 \$10.95 Order Both Volumes and Save! BK738402 \$18.95

KILOBAUD KLASROOM—by George Young and Peter Stark. Learning electronics theory without practice isn't easy. And it's no fun to build an electronics project that you can't use. *Kilobaud Klassroom*, the popular series first published in *Kilobaud Microcomputing*, combines theory with practice. This is a practical course in digital electronics. It starts out with very simple electronics projects, and by the end of the course you'll construct your own working microcomputer!

Authors Young and Stark are experienced teachers, and their approach is simple and direct. Whether you're learning at home or in the classroom, this book provides you with a solid background in electronics—and you'll own a computer that you built yourself! BK7386 \$14.95

TEXTEDIT—A Complete Word Processing System in Kit Form—by Irwin Rappaport. *TEXTEDIT* is an inexpensive word processor that you can adapt to suit your differing needs—from form letters to lengthy texts. Written in TRS-80 Disk BASIC, the system consists of several modules, permitting the loading and use of only those portions needed. A disk is also available which provides the direct loading of the modules, however, the book is required for documentation. For Model I and III with TRSDOS CONVERT, one disk drive (2 disk drives or copy utility needed to transfer to system disk). Runs under TRSDOS 2.2/2.3. May not function under other systems. BK7387 \$9.97 Disk DS7387 \$19.97

THE NEW WEATHER SATELLITE HANDBOOK—by Dr. Ralph E. Taggart WB8DQT. Here is the completely updated and revised edition of the best-selling *Weather Satellite Handbook*—containing all the information on the most sophisticated and effective spacecraft now in orbit. Dr. Taggart has written this book to serve both the experienced amateur satellite enthusiast and the newcomer. This book is an introduction to satellite watching, that tells you how to construct a complete and highly effective ground station. Not just ideas, but solid hardware designs and all the instructions necessary to operate the equipment are included. An entire chapter is devoted to microcomputers and the Weather Satellite Station, and for the thousands of experimenters who are operating stations. *The New Weather Satellite Handbook* details all the procedures necessary to follow the current spacecraft. Weather Satellite contains Operation Satellite Systems, Antenna Systems, Weather Satellite Receivers, A Cathode Ray Tube (CRT) Monitor for Satellite Picture Display, A Direct-Printing Facsimile System for Weather Satellite Display, How to Find the Satellite, Test Equipment, Microcomputers and the Weather Satellite Station, Station Operations. BK7383 \$8.95.

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FEEDBACK LOOP

by Terry Kepner

Send any questions or problems dealing with any area of TRS-80 microcomputing to Feedback Loop, 80 Micro, 80 Pine St., Peterborough, NH 03458.



I am from Venezuela, living temporarily in the United States. I have two 48K Level II dual-disk Model I's. Several of my friends have similar configurations.

Not long ago a friend in Venezuela asked me to get him a new set of Level II ROMs. He has the three-set, and his ROM B went bad. Since Radio Shack is out of the three-ROM sets, I tried to find the commercial number for the ROMs so we can use the ROM programmer to make one of our own. No one seems to know the number. Can you help?

One other question: I'm using Profile for the Model I as an inventory program for all the items I will take home. With it, I can list them item by item by the box they're packed in—just right for Customs. But Profile doesn't do any arithmetic operations and I want to be able to add the dollar amounts by the page, and then convert them to my country's currency. Also, how can you modify Profile to open more files than it currently uses?

R.B.
Rochester, MN

I don't know the exact ID numbers of the ROMs you want, but you can replace the Level II ROMs with 2716 (2K by 1 byte), 2732 (4K by 1 byte), or 2764 (8K by 1 byte) EPROMs from any one of several manufacturers. I believe the Level II ROM B chip is a 4K by 1 byte ROM.

For more information about your Model I and how to modify it, get Dennis Kitz's book *The Custom TRS-80* from IJG (see address at the end of the column).

I updated my ham shack by adding a Model III. I use it for QSLing, log keeping, and other related chores. My problem is RFI. I can copy only the strongest of signals over the computer generated noise.

I have good grounds on all the com-

ponents (computer, HF rig, interface, and antenna) and use a shielded cable between the interface and radio. Physically separating the Model III from the radio helped, but it makes operating inconvenient.

I want to shield the inside of the Model III with copper screen and install RF filters at various places in the computer. I need to know where to put the filters and if the shielding will help.

R.S.
Norwalk, CA

Yes, shielding will help. Besides just adding shielding and filters, make sure that the internal cable grounding is secure. I've seen more than one Model III with grounding cables improperly connected.

Your primary problem areas are the keyboard (which acts like an antenna), the main circuit board, and the disk drives. For safety reasons, I suggest that you get insulated copper screen. This lessens the chance of the copper screen accidentally grounding out the video monitor and power supplies.

Run the screen all through the cabinet (you'll probably have to remove the drives and power supplies from the bottom of the case to get the screen beneath them). Place a filter on the drive enclosure, keyboard, and one on both sides of the main circuit board. Since the Model III case is in two distinct sections, you'll have to attach the two wire screens (one in the bottom and one in the top) together with a 20-inch cable so you'll have room to lift and move the top of the case.

At the moment, I haven't heard from anyone who has tried to shield their computers from RFI, so I really don't know of any single, sure-fire method to accomplish it.

I'm looking for a genealogy program for a two-drive Model III. I need both

pedigree and family group sheet capability. Can you help?

W.G.
Salt Lake City, UT

Smartware Systems (14310 Pembroke, San Antonio, TX 78247, 512-494-0285) has a program called Gensystems Genealogical Data Base for \$128.45.

Acorn Software Products (634 N. Carolina Ave. S.E., Washington, DC 20003, 202-544-4259), Computer Shack (1691 Eason, Pontiac, MI 48054, 313-673-2224), and J. Fisk Software Systems Inc. (One University Place, New York, NY 10003), all have genealogy programs for the Model III, but I don't have any price or other information about them.

Who and what is Winchester of hard disk fame?

D.L.
Tucson, AZ

Winchester disk technology was developed in the mid-1970s as an alternative to the expensive hard-disk drives then available. The newer drive system was much smaller, more temperature tolerant, and easier to use than the older units. It was also much cheaper.

The Winchester disk drive is a sealed unit with a fast-rotating, high data-density disk. Being a sealed unit, the critical read/write head tolerances are easy to maintain; the complex and expensive head mechanism that allowed you to change disk packs on the older units isn't needed. While this means less memory storage, it also means less expense. Since the unit was designed for microcomputers, whose owners were more interested in low cost than extremely high data storage capability, the trade-off was worthwhile.

I believe that the name was derived from the research company that came up with the design, Winchester Technology.

I have a Model III with two Radio Shack disk drives. I recently purchased a commercial program that came with DOSPLUS 3.4. My problem is that

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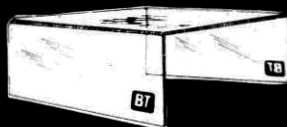
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FEEDBACK LOOP

whenever I format a disk with DOS-PLUS, several grans are locked out. Formatting the same disk with TRS-DOS produces no errors. I took the unit to Radio Shack for drive alignment and check-out, but the problem still exists.

*J.M.
Stillwater, MN*

Your problem is probably the drive stepping rate DOSPLUS uses. The Radio Shack drives require a certain amount of time to step between tracks. Since each step jolts the head mechanism, you need additional time for the head to settle. Typically, Radio Shack drives need a stepping time of 40 milliseconds. You can buy drives with stepping times as low as 6 milliseconds. Using a stepping time that's too fast results in the drive head either miswriting or misreading the data. Either case locks out a gran during format.

To find out what your version of DOSPLUS uses as a stepping rate, type CONFIG and press the enter key at the DOSPLUS prompt. It should say STEP=30. To change the stepping rate, type CONFIG :0 (STEP=40) and then press the enter key. If this doesn't work, call the DOSPLUS trouble desk at 305-983-3390.

I have a Model III with two drives. The system works fine except after power-on and the disk system's initial run. If the DOS disk isn't inserted and boot-ed within 20-25 seconds, the drive starts to run again and sometimes won't shut off without turning the system off and then back on.

*T.C.
Carlisle, OH*

My Radio Shack technician tells me, based on what you've said, "Something's probably wrong, bring it in." The drive and drive light, once off, shouldn't start again until you press reset.

I have a Level II, 16K Model I with CTR-41 stringy-floppy, and Okidata 80 printer. When the cassette recorder broke down for the second time, I went to Radio Shack and bought the newest recorder, which I couldn't get to work. The repair center said it was OK, but I still couldn't make it work. It loaded a program but wouldn't save and reload a saved program.

I took everything to the store and

showed them that it wouldn't work. They checked the recorder again, OK'd it, but it still wouldn't work. I tried another, cheaper Radio Shack cassette recorder and it wouldn't work either. I finally sent the CTR-41 in for repair, and now it works fine. My question is: Should any Radio Shack cassette recorder work with my computer? Any ideas on why mine doesn't?

Second, while checking out disks, I wrote to Aerocomp and asked if their Model I starter packages would run as a drive zero or if it was for positions 1, 2, or 3 only. They didn't answer; can you?

*D.R.
Mason City, IA*

You shouldn't have any difficulty using any cassette recorder with the Model I. The only real requirements are that the recorder have jacks for an AUX input and an earphone output.

Something is wrong with your Model I. It sounds like you've never had the XRX cassette modification made to your computer. This modification makes it easier for early production units of the Model I to more easily save and load programs. The original Model I units are very sensitive to volume and speed settings on tape units. Very minor alterations in speed by the recorder while saving or loading a program frequently make it impossible to recover the program. The XRX modification corrects this problem and gives the Model I a much wider volume load range.

As for Aerocomp, the start-up package is a drive zero unit (that's why it's called a start-up package and not called an add-on package). Before you can use disk drives with your Model I, you'll need an Expansion Interface (EI) with disk controller circuitry. The Model I, without EI, doesn't have the proper control circuits for disk drives. You'll also need the additional memory available in an Expansion Interface. Trying to use disk drives in a 16K computer is difficult since you only have about 5K of programming room left after loading DOS and DOS Basic.

I have a 48K one-disk Model I with a Line Printer I. I use TRSDOS 2.3 and Disk Basic 2.2. My problems are with the LP I.

First, the printer paper has a tendency to slowly slide to the right whenever I print more than 10 lines. Second, when-

ever I have the command CHR\$(138) embedded in an LPRINT, the printer only prints part of the line when it prints it at all. Finally, it prints a line feed only if you use LPRINT " ", POKE &H37E8,10, or LPRINT CHR\$(138).

Do you know of any fixes? And can I modify the printer to accept single sheets?

*M.C.
Mexico City, Mexico*

You can solve the paper creep problem only by buying a tractor-feed mechanism for the LP I. This firmly holds the paper in place. The friction-feed printer takes only roll paper, and there's no solution for preventing creep when you use it. It's too bad, but as far as I know, there isn't a way to use cut-sheet paper with the LP I.

The design of the LP I requires that you use either LPRINT " " or LPRINT CHR\$(138) to line feed. Embedding the CHR\$(138) in a string of text causes logic problems since the printer expects the line feed command to come as the first character of the string following LPRINT. In fact, the character 138 is actually a graphics character, but the bit image of the character and the reaction of the printer to the character results in a line feed. It really isn't supposed to be a line feed character, but that's the way the printer treats it.

If you have a tractor-feed mechanism, you can order letterhead stationery, filing cards, postcards, and various other forms with holes to fit the tractor-feed from NEBS at 800-225-9950 (Massachusetts customers call 800-922-8560).

I'm sorry, but the only real solution for your problems is a newer printer that's designed better than the LP I.

I have had my Model I for almost two years and I've finally decided to get a printer. My choices have narrowed down to the Epson MX-80 and the Gemini 10. My problem is that I don't know if the Gemini 10 printer works with Dot Writer 1.5. Does it? If it doesn't, is there a patch available?

*M.S.
Elmira, Ontario*

Please, when you write about products, give me the names and addresses of the manufacturers. Trying to find information about product ABZ is very

difficult unless I happen to know the product in question.

The manufacturers of Dot Writer, RCM Computers, tell me that the Gemini 10 is not compatible with Dot Writer. The Epson is. And, as far as I know, there isn't a patch to Dot Writer that does make it compatible.

I want to build my own disk hardware using a 2791 instead of a 1771 or 1791 disk controller chip. The 2791 only reads or writes in the IBM 3740 (single-density) or IBM 34 (double-density) formats. The 1771 uses these and non-IBM formats.

I would like to be compatible with all Model I software, and I would appreciate it if you could tell me if there are any software packages that use non-IBM format.

L.P.
Melvindale, MI

Most Model I software uses the IBM single-density format. The only exceptions might be some of the special-purpose, copy-protected packages, like Super Utility Plus for example. As for which ones do and which ones don't, I can't really determine. If the alteration was done for copy protection the author wouldn't tell me, since it would be a clue to software thieves. Good luck with your design.

I have a one-disk system and I recently purchased software that has no DOS on it. Thus I am required to locate a two-drive system to get the programs to operate.

Can you tell me why both disks must contain a DOS to make single-drive copies? Dealers and other owners haven't provided an answer. Is there a way around this problem?

A.P.
Pittsburg, CA

Laziness is the answer. It's easier for the TRSDOS programmers to write a copy routine that requires a DOS disk in drive zero than to write one that is independent of the DOS.

Basically, the problem is room. When creating a DOS you have two choices: write a DOS that takes up lots of room in memory and doesn't require anything on disk, or one that takes only a little room in memory and constantly refers to the disk for routines not in

memory. TRSDOS takes up a lot of space on the disk in order to leave you lots of room in memory. This lets them make a very powerful DOS, with many features, while leaving the programmer as much room in memory as possible.

On the other hand, CP/M moves the entire DOS into memory. It's less powerful and has fewer features, but it doesn't require a disk in drive zero to always have the DOS on it. That doesn't excuse the requirement for DOS on the disk for the Copy utility. Several other DOS manufacturers (DOSPLUS, MULTIDOS, and LDOS, to name a few), do provide a single drive copy utility.

If you don't want to buy another DOS (\$99 and up), you can get Super Utility Plus from Powersoft (11500 Stemmons Fwy., Suite 125, Dallas, TX 75229, 214-484-2976, \$74.95). It lets you copy programs from one disk to another, regardless of their length. And it's also one of the most powerful disk utilities you can buy.

I've been having a problem with my computers that has been driving me up the wall. I would appreciate your comments.

I'm using two Model IIIs with LDOS. One of them has an MPI 80-track double-sided drive. After using the 80-track drive for a year I started to have problems with directory and formatting errors. When formatting, the drive occasionally skips a track.

I took the drive in to be checked out. It was tested on other computers (non-Tandy) and it works fine. I then bought another 80-track drive (Siemens), which now has the same problem. Interchanging three computers with three drives didn't solve the problem either.

Eventually the local experts changed the outgoing pulse on the disk controller board and I now have one computer that works pretty well with a Tandon 80-track drive. The other computer works fine, but will only format the 80-track double-sided disk using single-density.

B.M.
Durban, South Africa

Your problem is a basic incompatibility between the drives and the computer's disk controller board. Due to age, the tolerances of the disk controller board have drifted slightly; enough to cause problems with 80-track drives.

The problem is with the computers and not the drives because the drives work fine with non-Tandy computers. Malfunctioning drives would fail with all types of computers, not just one brand.

Unfortunately for you, the disk controller board is still well within its designed tolerances. That is, it should work just fine with 40-track double-density drives; otherwise you might be able to talk Tandy into replacing them.

The decrease in reliability you've seen is due to an aging curve, to which all electronics are subject. As they get older, they work less efficiently and slow down. Most designers take this age curve into account when they build something and leave enough room in the tolerances to prevent this decay from affecting the performance of the unit. Double-density, 80-track drives push the disk controller boards close to their limit. Depending on the individual components on the board, a particular board may work fine with 80-track drives for a limited time, forever, or not at all. It's a roulette wheel as to which way it'll go with any particular Model III.

Does anyone else have a hardware solution for B.M.?

Is there any way to convert the Avalon Hill game Tankics to Disk Basic? The POKES foul up the DOS.

C.W.
Granada Hills, CA

You'll have to contact Avalon Hill for information about whether or not you can do that. If it's possible, they should know. It's possible that the POKES are minor and can be moved easily.

I have a 48K Model I with Aerocomp doubler and 80- and 35-track disk drives. Could you please list manufacturers of Model I CP/M boards and which, in your opinion, is best.

I would like CP/M, but I'm averse to soldering.

F.G.
Lewiston, ID

Holmes Engineering (5175 Green Pine Drive, Murray, UT 84107, 801-261-5652) has a CP/M board for the Model I, and it includes an 80 by 24 video screen display. The 80 by 24 hardware and CP/M cost \$399.50. To use it you need the Holmes expansion main-

frame for the Model I (\$99.50). The Holmes CP/M modification includes the CP/M operating system and instructions on it. Installation requires no soldering or technical experience. Contact Holmes for details.

Microhatch (P.O. Box 501, Dewitt, NY 13214, 315-446-8031) sells Bignem, a hardware kit that increases memory by 32K (\$180), and lets you use CP/M 2.2 (\$119). This kit requires soldering and some technical experience.

Omikron (1127 Hearst St., Berkeley, CA 94702, 415-845-8013) sells the Mapper I/48 and Mapper I/64 for the Model I. I have no further information about the Omikron.

Freedom Technology (119 North 18th St., Philadelphia, PA 19103, 800-523-4067) has the Freedom Option and Freedom Plus for the Model I and III. The first board (\$275) gives you CP/M capability, the second (\$490) gives you 64K RAM in your computer.

I haven't seen any of these products so I can't give an opinion on the boards themselves. However, Holmes Engineering has a good reputation among hardware hackers for the quality of the work they put into their other products, so I'd expect the Holmes board to be well built.

I would like to establish a bulletin board system (BBS) that would let users send, receive, and forward messages with the ability to upload and download programs written in Basic or Assembly language. I need it to work on a Model I or III, appropriately configured with RS-232, modem, and disk drives. It must support IBM PC, Apple II, Apple III, and TRS-80 Models I, II, and III computer systems.

I'd also like to know about any software to translate Basic from one machine's dialect to another machine's dialect (IBM to Apple, Apple to TRS-80, etc.).

J.G.
Chicago, IL

As far as translating programs is concerned, the only program I know of was published in the premier issue of *inCider* (January 1983, p. 96), which converted TRS-80 to Apple Basic.

There're several bulletin board systems available for the Model I and III computers: Mouse-Net, from Lance Micklus 802-864-5899; Forum-80, from

Small Business Systems 617-692-3800; and Connection-80, from B.T. Enterprises 516-567-8155. I know there are others, but I can't find any information on them.

These systems support upload and download capabilities with message leave, retrieve, and referral (you can leave a message to a specific person and they are notified that a message is addressed to them when they sign on). Most bulletin board systems allow any microcomputer or terminal to sign on to their system, as long as the foreign computer or terminal obeys the system's protocols of word length, stop bits, parity checking, and control codes. In fact, the control codes used are pretty much the same from one system to another. For example, Control-C is frequently used to abort the current operation and return to terminal control mode.

For your use, select the options that represent the least common denominator of the systems you're allowing on. That is, if the smallest screen width terminal that will be on the BBS is an Apple, then the default screen width used by the BBS should be 40 columns. Since the smallest number of video lines belongs to the Model I computer, your BBS screen length should be 16 lines. Thus the BBS formats its menus and information screens in blocks of 40 characters by 16 lines. The computers with wider screens or higher line counts won't be inconvenienced too much, while the smaller-screened computers are still able to use the system.

For further information about these BBSes, call the different manufacturers and ask for details.

I'm very good at Basic programming, but I know little about machine-language programming.

My question is: How do you assemble a machine-language program (list it out on the screen), save it to tape, locate it in memory, and so forth? I've tried to enter a program many times, but all I get is garbage when I try to list it.

I understand how the computer starts off with Basic, branches to machine language, and then returns, plus some of the operations and arguments to do that sort of task.

D.H.
Buellton, CA

Your first problem is in your conception of machine-language program-

ming. You can't just type in a machine-language program and expect it to work. When you turn on your computer you're in Basic, and the computer expects everything you type in to be in the form of Basic commands and instructions that it can understand and execute. Basic is a machine-language program itself and it doesn't expect to execute machine-language programs as a regular course of action. When you branch to a machine-language program, that's exactly what you do—you transfer all control of the computer to the machine-language program. Basic is no longer in control and doesn't even know what the machine-language program does or is doing.

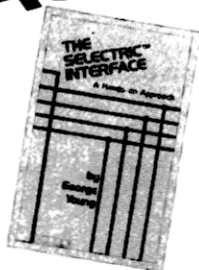
As a help to machine-language programs, Tandy included the ability to branch to a machine-language program using Basic commands, and even to pass arguments (information) between Basic and the machine-language program, although only in a very limited manner.

To write a machine-language program, you need a program called an editor/assembler. An editor/assembler is actually two programs: one allows you to type in and edit your machine-language programs; the other translates the machine-language mnemonics you typed in into actual machine-language code understandable directly by the Z80 CPU.

The editor/assembler has two types of output, source code and object code. The source code is a listing of the mnemonic instructions of your machine-language program. The object code is the actual program created from your source code. You can list, edit, renumber, save, and read the source code with the editor/assembler. The object code is generated by the editor/assembler from the source code, and can't be read back into memory by the editor/assembler. The object code is meant to be read and executed by the Z80 CPU only, although some disassemblers take object code and generate source code readable by an editor/assembler.

Once you have the object code on tape or disk, you protect the program from Basic's accidentally overwriting it with variables and arrays by using the MEMORY SIZE? prompt and specifying the lowest address of the program. Then load it into your computer's memory and execute it. If the program is to interact with a Basic program, you must use POKE or DEFUSR to tell Basic that

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there's a machine-language program available and to define the program's starting address and the USR function to activate it.

The starting address of your program is determined by the address you give in the ORG statement in the editor/assembler, so you can specify any address that's convenient for your needs (available memory does put constraints on this, of course).

The first thing you need to do is to get an editor/assembler. Check the back issues of *80 Micro* for information about the various ones available, what they do, and their prices.

I have a Model I with 32K Expansion Interface, Okidata 82A printer, and one Teac drive with DOSPLUS 3.3. Everything worked fine for a few weeks after I bought the drive, then I started having difficulty entering Basic from a cold boot. Machine-language programs work fine, but to call up DOSPLUS Extended Basic requires a three- to five-minute warmup for the CPU (process of elimination refined the times).

When I try for Basic from a cold start, I get Debug instead. I took the keyboard/CPU to Radio Shack who said they had never heard of the problem, but they installed a new CPU switch. I still have the problem.

I also found that I can no longer use the computer as a 16K machine without the five-minute warmup. Can you help?

R.L.
Bowie, MD

Do you mean to say that your 16K Model I requires a five-minute warmup before you can use it and that the repair center can't find a problem? I find that very hard to believe. If the 16K Level II doesn't immediately work when turned on then something is very wrong! It's possible that your problem is the power supply. Have you tried the unit with the expansion interface power supply?

First, disconnect everything from the CPU and reconnect the video, tape, and power supply. Turn everything on. If the computer doesn't immediately begin working correctly, proceed to step two. Test the unit with several programs to make sure it's working correctly. If everything works, you know the CPU, video, and power supply are OK.

Step 2: Switch power supplies and repeat the test. Run several programs

again. If there are problems when there weren't any before, the problem is in your outboard power supply. Similarly, if just switching the power supplies solves the problem, the former power supply was at fault. If neither power supply changes the problem, go to Step 5.

Step 3: Turn everything off, connect the expansion interface, without drives or printer attached, and turn everything back on. Test the computer. If the problem shows up, go to Step 5.

Step 4: Turn everything off and connect your disk drive to the system. Turn it back on. If the problem shows up now, the difficulty is either in the disk controller circuitry in the expansion interface, or in the disk drive. Borrow a drive from a friend and test your computer with it (get a Radio Shack drive if you can). If the problem persists, test your drive with another computer system. If the drives work with someone else's system and not with yours, the problem is probably with the expansion interface. Go to Step 5. If the drive is the problem, you'll have to complain to the people from whom you bought the drive.

Step 5: Take everything to the Radio Shack repair center and show the technician what's happening. You have something concrete to demonstrate and complain about. While the technician won't work on a non-Tandy drive, you can at least show him what you're talking about. Have him attach a Radio Shack drive and test your system. If the problem doesn't appear, then your drive is at fault; call the manufacturer.

I need some help with my 16K Model I. I'm trying to learn how to use the Radio Shack EDTASM (26-2011), and I have a lot of questions.

First, how can I copy a machine-language tape? I have KBFIX, TBUG, and EDTASM which I want to duplicate, but I don't know how.

Second, how do I display machine code on the monitor? Basic uses the command List. What does EDTASM use?

Third, when I have EDTASM loaded, is it possible to go to Basic without losing my program? Typing Q takes me to Print Memory and everything bombs.

E.B.
Joliet, IL

You can copy tapes using TBUG, but you have to know the starting, ending, and transfer (execution) addresses for the programs you want to copy. The easiest solution is to buy a program for copying tape-based programs. There're several available—check through the advertisements in *80 Micro*.

You can't display machine code on the video unless you're using an editor/assembler or disassembler to do the work. There is no Basic command for listing machine code. In EDTASM, the command P#* should list all the text in the EDTASM buffer to the video. The H command sends the listing to the printer.

The only other method I know of to return to Basic is to press the reset button, which returns you to the MEMORY SIZE? prompt. The B command used to do that on older versions of EDTASM. Newer versions use the Q command. In general, this doesn't save your program, since EDTASM may not actually store the machine code generated by the assembly instruction in those actual locations. What you have to do is to write the object code to tape, then load the program using the CLOAD command of Basic.

I have a Model I disk system with a Holmes Sprinter I and Radio Shack double-density board. I bought the Radio Shack Series I Editor/Assembler and discovered that it comes with DOS 2.3B which appears incompatible with either 2.3 or 2.7DD.

Since I had it, I decided to try it out by compiling a source-code program from one of my Load 80 disks, but no luck. The only one that gave a clean compile wouldn't work with TRSDOS 2.7DD. Texas headquarters couldn't help.

Now, all I really want is to assemble listings from magazines and use those supplied on Load 80 disks. Can you suggest another assembler that might work for me?

M.W.
Columbus, OH

It's not your fault or EDTASM's. The Load 80 disks use the Apparat format for source code, which isn't compatible with Radio Shack's EDTASM programs. Using the EDTASM program on a Load 80 source code file results in a Parameter Error message. If

you don't get the message, the code still isn't right and won't work properly.

The April 1983 issue of *80 Micro* (Reload 80, p. 404), has a patch that fixes this incompatibility. The April 1983 Load 80 disk also has the program. Finally, you can send a disk to *80 Micro* and they'll put the program on your disk for you.

If you still have problems, the difficulty is with your DOS. I suggest you get MULTIDOS from Cosmopolitan Electronics Corporation (5700 Plymouth Road, Ann Arbor, MI 48105, 800-392-3785, \$99.95). This DOS supports both single- and double-density, and all known types of double-density boards (Radio Shack's board is non-standard; everybody else uses the same port and addressing schemes). I think you'll find MULTIDOS to be better than TRSDOS 2.7DD, while still being simple to use and easy to learn. MULTIDOS also includes the original tape-based EDTASM patched to operate in a DOS environment. This program will read Load 80 source codes.

I have a Model 16 with Okidata Microline 83A printer. When I use Scripsit 2.1.0, the printer prints erratically. I'm sure the printer driver used in Scripsit is the problem. Do you know of a driver designed for the Scripsit 2.1.0/Microline 83A combination?

W.L.C.
Ellijay, GA

I've seen several advertisements in *80 Micro* for drivers for the Scripsit. Also, in the April 1983 issue, we ran a special Feedback Loop column (p. 376) on Scripsit and printer problems. Several of the people who wrote in are now selling the drivers. Contact the companies mentioned in the April issue for drivers to match your need.

I have a 16K Model I. I want to do several things: add memory to the keyboard, a la the Holmes Engineering IM-2, and a printer, and add disk drives.

My questions are:

● *Can I install the IM-2 unit, and is that as good as Radio Shack's or other expansion units?*

● *Is there one particularly better printer than any other? My price range is around \$600.*

● *What type of drive is best for my pur-*

poses? I don't know hard disk from stringy, from floppy.

● *Can all this be done without an expansion interface?*

C.A.
Phoenix, AZ

You can install the IM-2 without electronics experience; it requires no soldering. You do have to know how to follow instructions to the letter (something few people do—they seem to think instructions were sent as packing material and not something you have to read before you build something). The unit only adds memory.

The best printer for the price that I've seen is the D-92 from Data Impact Products (745 Atlantic Ave., Boston, MA 02111, 617-482-4214). It's a dot-matrix printer with correspondence and data processing modes. It's a parallel printer with optional dot-addressable graphics (\$30), tractor feed (\$50), 2K printer buffer (\$35), cut-sheet feed tray (\$45), and sound cover (\$30). I've used the printer and it performs well. It retails for \$399. Options add to the price, of course. Oh, almost forgot, it prints bidirectionally at 100 characters per second and supports 5, 6, 8.25, 10, 12, and 16.5 characters per inch with underlining, enhanced (bold face) printing, and front panel controls.

For your first drive, I suggest you get a 40-track double-density drive. Stringy floppies are miniature, endless-loop cassette tapes in a special drive. They can store almost as much information as a floppy disk, but have longer access times (anywhere from a few seconds to 15 or 20 seconds). Their advantage is that they are cheaper than conventional disk drives.

Hard disks are for mass storage of millions of bytes of information. Most hard disks require that you already have a standard floppy disk drive. If you want to buy commercial disk software, you need a standard 40-track drive. If you don't mind the inconvenience of some software being unavailable to you, you could get an 80-track drive.

To operate disk drives on your Model I requires an outboard expansion interface. There's no way to escape it; there just isn't enough room in the CPU/keyboard unit for all the electronics required for disk drives.

I don't know for sure which expansion interface is best. I've used the

LNW interface, which you can build from a kit, and had few problems (this was several years ago and there have been several improvements). I thought it was all right, but most of my friends didn't like it, although all conceded it was better than the Radio Shack Expansion Interface. According to my technical friends, the Holmes unit is well-designed and solidly built with excellent customer support. And the MicroMint Disk-80 Expansion Interface is just as well-designed.

I recommend that you select an expansion interface to fit your budget and needs. Buying the memory unit now will be a waste since you'll end up duplicating the circuitry when you buy an expansion interface for the disk drive upgrade. You should start by calling Holmes and asking them about their upgrade.

My problem is with Scripsit 1.0. I have a two-drive 48K Model III. I prefer to keep the system disk in drive zero and save and load files on drive 1. I have TRSDOS 1.2 and 1.3, LDOS 5.1.3, and NEWDOS80 2.0.

First, how do I get a directory from Scripsit in these DOSes? Second, how can I convert Scripsit to work on LDOS? I tried to do it, but it didn't work. I want to use LDOS because of its spooler function.

R.P.
Weatherford, TX

First, Scripsit doesn't support directory examination by the user. Acorn Software has a patch program that lets you examine the directory from Scripsit, as well as providing other useful functions. If you're in LDOS, I believe that it has a mini-DOS you can invoke from within any program. This mini-DOS should allow you to examine the directory and return to Scripsit with your file intact.

LDOS requires that you patch Scripsit before you can use it. You'll have to contact the LDOS support desk for the exact patches. If you're a registered owner, you should easily get the information you need. If not, buy LDOS.

I own a 48K two-drive Model III with Epson printer and Radio Shack High Resolution Graphics Board. The board works fine except that I can't get it to work with my printer. The printer rou-

FEEDBACK LOOP

time requires that you have a Tandy printer. Although the source code is listed in the manual, I know too little of Assembly-language programming to attempt to make the necessary alterations. Can you help?

J.C.
Raleigh, NC

I'm afraid I don't know enough about it to do it myself, either. Has anyone modified the printer driver for the Radio Shack Hi-Res Graphics Board to work with an Epson printer?

Can I patch TRSDOS for a 5-millisecond stepping rate?

A.W.G.
Goose Creek, SC

You can patch TRSDOS, but if you're using standard Radio Shack drives it won't do you much good since they won't step any faster than 30 ms. Offhand, I don't know what the patches are—does anyone have them

handy? If so, let me know and I'll print them here.

I have a problem with the storage of files on my 48K Level II Model I system which has two 40-track and two 80-track drives. I have a time-sheet program which creates a file for each client on the 80-track drives. I have 110 grants left, but zero directory space. Is it possible to amend the directory through PDRIVE, to give me more space?

Also, is it possible to software force a printer to produce only 80 columns and then carriage return instead of going to 132 columns? I want to use 8-inch paper and the printhead keeps going off the paper.

T.R.M.
London, England

Yes, you can use PDRIVE to increase directory space. Simply assign the directory a length of two or more tracks. The DDST parameter specifies the starting track number of the directory. The DDGA parameter tells the system the length of the directory in grants. Default DDGA is two. A DDGA of three has room for 104 entries, DDGA four will hold 144, DDGA five gives 184, and DDGA six gives 224 file entries in the directory.

There is a way to restrict software listings to only 80 columns, but I think you need a special printer driver to do it. In theory, you use the Device Control Bytes in low RAM to take printer control away from the ROM and give it to your printer driver which counts the bytes sent to the printer. When it reaches the 80th byte since the last carriage return and line feed it sends a carriage return and line feed and starts counting at zero. Does anyone have a simple program to handle T.R.M.'s problem?

UPDATE

A month or so ago a question about line feeds and TRS-80 Model I's appeared. It seems that some software packages don't form feed properly with certain printers. The crux of the problem is that the original Radio Shack printer, the LP I, ignores multiple carriage returns without intervening printable text (LPRINT:LPRINT:LPRINT gives only one carriage return, LPRINT""LPRINT""LPRINT"" is required).

To fix later version Model I's, Tandy came up with a program called LPC that adds a patch to these later versions of Basic which makes them emulate the earliest version. Without this LPS patch, a top-of-form command (LPRINTCHR\$(12)) adds an extra carriage return/line feed each time it's executed with certain software packages.

You must load LPC before Basic in a DOS environment. LPC is available from any Radio Shack store. Ask for the LPC Driver, #700-2007.

These printers require LPC: LP III (26-1156), LP VI (26-1166), Daisy Wheel WP50 (26-1157), Qume Daisy Wheel (26-1157A), Daisy Wheel II (26-1158), and all of the DMP and DWP printers.

These printers do not need LPC: 26-1150, 26-1152, 26-1153, 26-1154, 26-1159, and the A version of the LP III (26-1156A).

These Radio Shack programs require that you use LPC: Inventory Control (26-1553), Disk Payroll (26-1556), Profile I (26-1562), and Standard and Poor's Stockpak (disk, 26-1507).

If you're using an 8-bit serial printer, these additional programs will require LPC: General Ledger (26-1552), Accounts Payable (26-1554), Accounts Receivable (26-1555), Concrete Takeoff (26-1557), Manufacturing Inventory Control (26-1559), and Fixed Asset (26-1560). ■

Terry Kepner is a freelance writer and programmer, and the vice president of Interpro. He's been writing about microcomputers since 1979.

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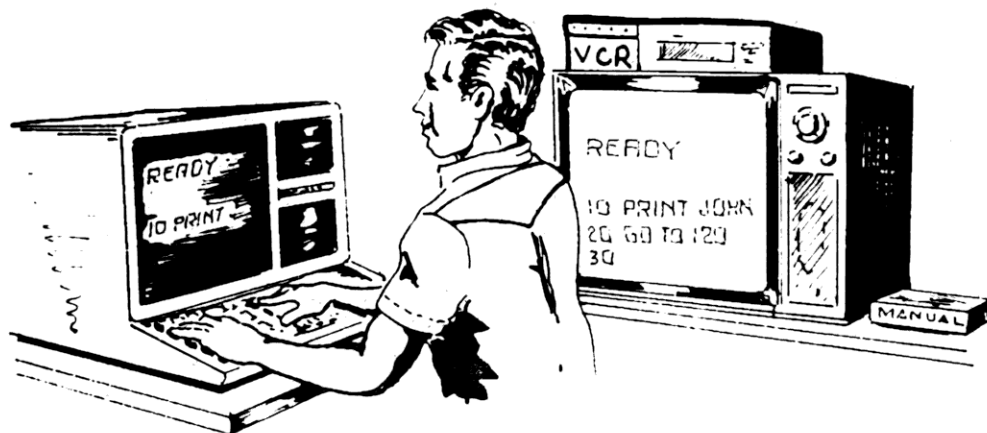
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Eric Maloney, 80 Micro's managing Editor, and I were talking one day when he admitted he'd never bothered to assemble a source-code listing off Load 80. "Why," he asked, "don't we put the assembled code on Load 80?"

Sometimes good ideas are so obvious you don't see them until they bite you. There are valid reasons for including source code on Load 80, the chief of which is if you need to modify the program, you have to have the source.

But assembling a program is a time-consuming process made complicated by the number of assemblers and assembler formats available for the TRS-80. If you just want to play a game or use a utility as provided by its author, then assembling the source code is a pain. It's also intimidating to those peo-

Introducing assembled code on Load 80

ple who use rather than program their computers. Users want to push the button and go. Makes sense to me; when I write a letter, I don't want to have to assemble Scripsit before I can compose my missive.

Load 80 disks and cassettes will now provide both the source and object code listings to our machine-language soft-

ware. The limiting factor is space. I try to provide as many of the magazine's programs as possible, and since object code takes up much less storage space on a disk or tape, it may be that some months a source-code version of a program is omitted to provide room for one or two extra executable programs.

You can determine each file's format by reading the file name's extension. As in the past, /BAS means Basic and /SRC means source code, but now you'll see more /CMD files indicating that you can execute the program as is.

To operate the specific programs, follow the directions the author provides in the magazine article. In general, however, disk users run /CMD programs by typing the file name in response to the DOS READY prompt. For example:

```
DOS READY
XXX <enter>
```

and the program runs.

You may notice that I omitted the /CMD extension. This is because the TRS-80's file name protocol defaults to /CMD. So you can get lazy when typing in the name of an executable machine-language program. You do it all the time with programs like Basic, Scripsit, and EDTASM. Conversely, you have to include /BAS or /SRC if you want the computer to find a Basic or source-code listing.

Cassette users are familiar with executable machine-language programs being referred to as "system tapes." For the most part, you'll run these programs by initializing Basic, typing SYSTEM, pressing the enter key, and entering the program's name in response to the * prompt.

On our printed Load 80 directories (found in this column and included with the product), the comment System appears next to executable machine-language programs.

Disk users who buy the Load 80 cassette can use the TRSDOS command TAPE to load the object code into the computer and save it to disk. Your TRSDOS manual has all the details.

I feel this is a major improvement. Load 80 is your source for timely, quality software, and now you'll be able to use all of it without the hassle of assembling listings. However, if you're up for the fun of customizing your software, the source code will still be there. I'd like your opinions on this new policy. ■

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November 1983 Load 80 disk directory.

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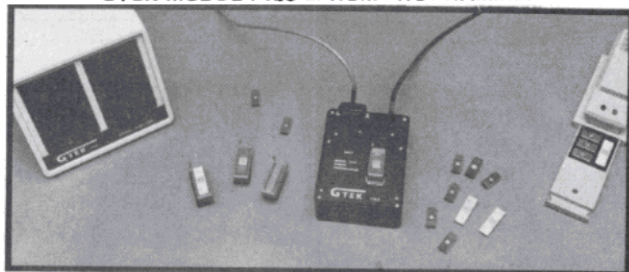
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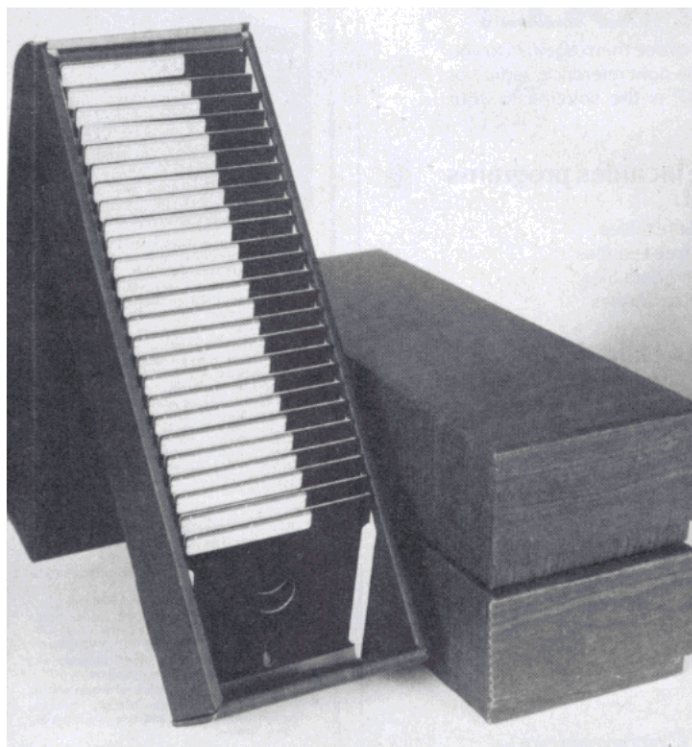
Soundtrap's inside dimensions are 26 inches across by 17 inches deep. Printer height limitations depend on your printer's shape and accessories.

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The program's character

editor file lets you generate alternate character sets. It has two separate ASCII character sets built in, as well as Greek, Hebrew, Katakana, and Russian alphabets and a set of mathematical and special characters.

Three printer subroutines written in Pascal 80 are provided for the Prowriter, Centronics 739, Epson MX-80 and 100, FX-80 and 100, and RX-80 printers to print out the high-resolution graphics screens.

The entire package comes complete with sample graphics routines, Pascal turtle graphics routines, a character generator, printer routines, and demonstration programs. It sells for \$39.95 and requires Pascal 80 and Radio Shack's high-resolution graphics board. For further information, contact New Classics Software, 239 Fox Hill Road, Denville, NJ 07834, 201-625-8838.

Reader Service ✓ 581

System Monitor

RSM3 is a machine-language monitor for the Models I, III, and 4. It has all the features of the earlier RSMII and RSM-2/2D, including the ability to dump memory in hex and ASCII, test, search, modify, verify, zero and fill memory, and so on. The symbolic dump command (Z80 disassembler) is a featured command. You can also create your own commands with the User area.

New characteristics of RSM3 include an all-new video editor so you can examine and modify both memory and disk sectors. The Model 4 version uses the 80-character screen mode for enhanced displays. Disk commands access any of four drives, and read and write both single- and double-density disks.

Controls for the video screen provide split-screen scrolling where only half the screen scrolls, allowing you to display up to 32 lines (48 on the Model 4) with some commands. You can adjust scroll speed from one to 30 lines per second.

Printers operate through either the parallel RS-232C or Trimtek's TRS232 printer ports at rates ranging from 110 to 9,600 baud. The monitor allows page length control and supports RS-232C handshaking.

RSM3 comes on a self-booting disk with a relocater so you can create over 200 different versions. It costs \$29.95 for the Model I; \$34.95 for the Model III; \$39.95 for the Model 4. Order directly from Trimtek Co., P.O. Box 5028-A, Thousand Oaks, CA 91360, 213-889-8142.

Reader Service ✓ 567

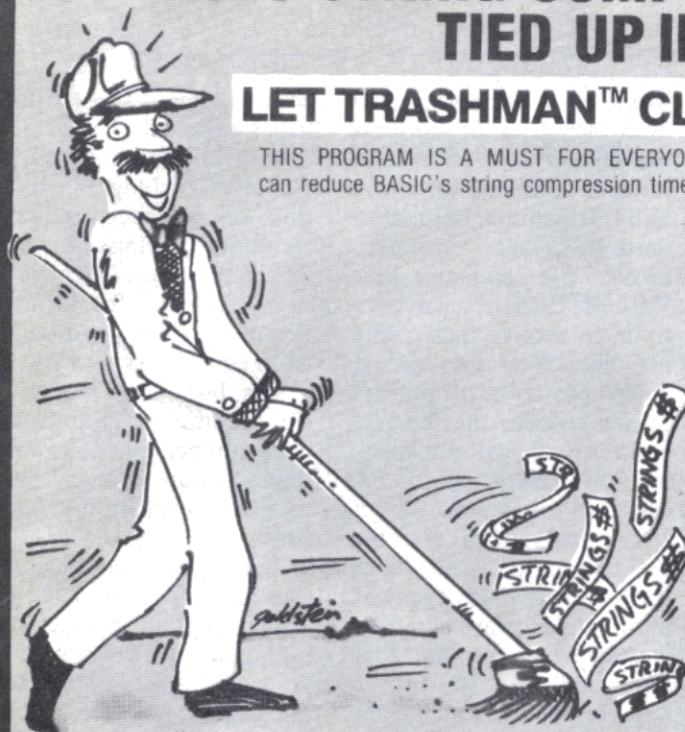
File Transfer

TransPro is a machine-language file transfer utility

DOES STRING COMPRESSION HAVE YOU TIED UP IN KNOTS?

LET TRASHMAN™ CLEAN UP THE MESS!

THIS PROGRAM IS A MUST FOR EVERYONE WHO USES "BASIC" ON A TRS-80. Why? Because it can reduce BASIC's string compression time delays by 95% or more.



WHAT'S STRING COMPRESSION?

When a BASIC program changes a string (words, names, descriptions), it moves it to a new place in memory, and leaves a hole in the old place. Eventually, all available memory gets used up and BASIC has to push the strings together to free up some space. This takes time. Lots of time. The computer stops running for seconds or minutes, and you may even think it's "crashed".

Yes! String compression is what's been causing all those intolerable delays. The keyboard won't work, and until all the strings have been collected, you just have to sit and wait. Then things run for a while, until string compression is needed again. And again.

If you're using your computer for business, that wastes your money. If you're using it personally, it wastes your time.

WHAT'S THE SOLUTION?

As soon as you start using TRASHMAN, those delays will almost disappear. The program is **very easy to use**, so you don't have to be a computer programmer to take advantage of it. It's written in "machine language" and uses only 578 bytes of memory for itself, plus two bytes for each "string" in your program. It works with other machine language programs and all the major operating systems.

HOW WELL DOES IT WORK?

If you use it with a BASIC program that has only a few strings, very little time is wasted in string compression, and TRASHMAN will be only slightly helpful. But, in programs that use hundreds or thousands of strings, including large string arrays, TRASHMAN is just what you need. If you have any remaining doubts, just look at the chart, and then get yourself a copy as fast as possible.

TRASHMAN is available on disk for just \$39.95.

ATTENTION SOFTWARE PUBLISHERS:

Trashman may be licensed for use with your packages. Call for details.

# STRINGS	SECONDS DELAY NORMAL	PERCENT TRASHMAN	IMPROVEMENT
250	11.8	0.7	94
500	45.8	1.6	96.5
1000	179.6	3.5	98
2000	713.2	7.8	98.9

(All timings done on TRS Model I. Model III 15% faster, but pct improvements identical. Listing of timing program available on request.)

SAVE TIME WITH FASTER



"FASTER" speeds up most TRS-80 BASIC programs by 20-50%. It's helped hundreds of satisfied people and it can help you. Detailed instructions make it easy to use. FASTER analyses your BASIC programs while they run, then displays a simple change, usually one line, that sequences program variables so the ROM will find them faster.

You can use FASTER to speed up programs you've bought, as well as programs of your own. Since it isn't a compiler, your BASIC programs can be read and changed afterwards. FASTER works on business programs, models, and games. The more complex your program, the better the results.

Does FASTER really work? Yes! Just check the reviews in *Personal Computing*, May, 1981, p. 116: "FASTER is effective and easy to use"; *80 U.S. Journal*, April, 1982, p. 106: "I recommend FASTER to everyone"; and *80 MICRO* (April, 1982, p. 40): "If you...would like a significant increase in the run-time speed, then buy FASTER."

FASTER runs on the TRS-80 Models I and III, 16-48K tape or disk, and all major operating systems. **\$29.95**

"QUICK COMPRESS" takes only 276 bytes of memory, and removes the blanks and remarks from even the largest BASIC program in less than 3 seconds. It produces smaller, faster programs without altering their logic. **\$19.95**

SPECIAL: FASTER and QUICK COMPRESS: \$39.95

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You can avoid unnecessary disk errors and repair bills by using **RPM**. This easy-to-use program measures the rotational speed and fluctuations of your disk drives, and warns you if they are running too fast, too slow, or unevenly.

Incorrect or erratic speed is a common cause of unexplained disk errors and loss of data. RPM's documentation explains how to detect and correct these problems quickly and easily. As *80 MICRO* (April, 1982, page 41) said: "If your drives have problems I recommend RPM before paying to get it repaired."

RPM is supplied on diskette for the TRS-80 Models I and III. We suggest you order a copy before you need it.

\$24.95

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for use with Radio Shack's Profile II and Profile Plus on Models II, 12, or 16. With TransPro, you can change the layout of a Profile data base by adding or deleting fields, changing field lengths, or moving fields to different segments. All existing data is then automatically moved into the new data base.

TransPro also inserts literal values into selected fields of an existing data base without changing the contents of other fields. You can also use this feature to blank out selected fields.

Priced at \$75, TransPro does not affect the operation of Profile programs, and operates on TRSDOS 2.0, 4.0, 4.1, or 4.2. It is sold by Bridgware, 355 Government St., Roanoke, AL 36274, 205-863-4006.

Reader Service ✓ 555

Color Plotter

The Model M260 is an eight-pen plotter developed by Strobe Inc. (897 Independence Ave., Building 5A, Mountain View, CA 94043, 415-969-5130). The plotter changes pens automatically under program control allowing unattended multi-color output on overhead transparencies or any 8½- by 11-inch paper. It offers a resolution of 500 steps per inch.

The suggested retail price of \$995 includes an Intelligent RS-232C interface that has a 1K buffer, upper- and lowercase character sets, several foreign languages, and a starter business graphics software package that lets you produce simple bar, pie, and line graphs. The graphics software runs on CP/M, MS-DOS, TRSDOS, and PC-DOS.

Reader Service ✓ 566

For the Model 4 . . .

Below are a few products

Micro-Systems Software Inc. (4301 18 Oak Circle, Boca Raton, FL 33431, 800-327-8724) offers for the Model 4:

DOSPLUS IV is an alternative to TRSDOS 6.0. It is fully compatible with all documented TRSDOS 6.0 supervisor calls, meaning that all programs written for TRSDOS operate under DOSPLUS IV. This operating system, with some enhancements, includes all the features of TRSDOS 6.0. It supports all Model 4 hardware, including an 80-column by 24-line video display and additional RAM. It costs \$149.95.

6.0 Plus gives you some of the powerful utilities of DOSPLUS IV without having to purchase the entire operating system. It includes a disk editor, file editor, and a directory verification/repair utility. The Basic enhancements provide shorthand immediate commands and abbreviated statements to make programming easier.

The Basic enhancements take on two forms: internal and external. External programs include a multi-array machine-language sort, cross referencer, and a global search and replace utility for Basic text. Internal enhancements include label addressing, extended error messages, and an expanded Option command.

Additions to the Option command provide compatibility with Model III Disk Basic. The Input@ command gives you controlled screen formatting for attractive applications software displays. 6.0 Plus costs \$49.95.

MTERM is a smart terminal program for the

Model 4. It supports 1,200 baud as well as the more exotic 2,400- and 4,800-baud modems without requiring nulls. It features both standard ASCII and error-free direct file transmission. With MTERM you can continue to receive data while off line. You can adjust video width, turn on the printer, open the buffer, and so forth without missing any information received in the interim.

The program has easy-to-use translation tables that let it emulate many types of terminal hardware. Its dialing menu lets you auto dial any one of 10 preset numbers at the touch of a key. MTERM is priced at \$79.95.

Reader Service ✓ 560

Become an Expert

You use Scripsit, but are you really using Scripsit to its fullest capabilities? With William Haga's book, *Using Scripsit*, you'll learn how to get the most out of Scripsit whether you are a first-time or experienced user.

Using the hands-on learning approach, *Using Scripsit* presents every Scripsit procedure step by step, telling you how to enter the

command and what effect the command has on a document when it's printed. Chapters include information on advanced editing techniques, block moves, search techniques, hyphenation, creative formatting, document filing, and using DOS commands.

The book also demystifies the header, footer, and page number functions, and discloses how to use Scripsit to edit records in data-base files.

The book includes exercises to test your skills in using program commands, examples following instructions, special boxed notices to the reader, and a common mistakes section at the end of each chapter.

Using Scripsit, a 320-page paperback, costs \$21.95 and is sold by Wadsworth Electronic Publishing Company (10 Davis Drive, Belmont, CA 94002, 800-831-6996).

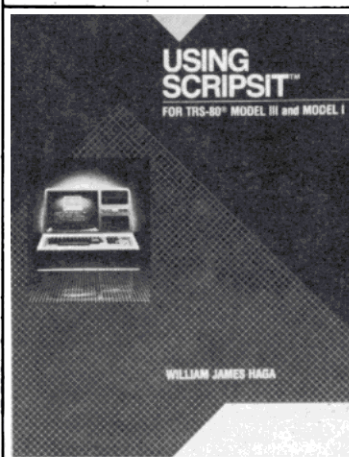
Reader Service ✓ 558

Filemate Data Base

Filemate is a general purpose data-base manager that creates its own file structure to meet the needs of most data handling or reporting requirements. You can tag records for logical And, Or, or Not selection for sorting and print-out. Each record accepts up to 26 tag combinations to obtain very selective sets of data.

Other Filemate features include data transfer from one file to another, merging the address list with a form letter, revise file structure without reentering data, and edit, sort, calculate, and print custom reports. Filemate stores up to 2,000 records on a 40-track disk.

Priced at \$75 for disk and manual, Filemate is available for Models I, III, and 4 with 48K and two disk drives. For further informa-



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WORD GRAPHICS DATA PROCESSOR

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Change Character Size or
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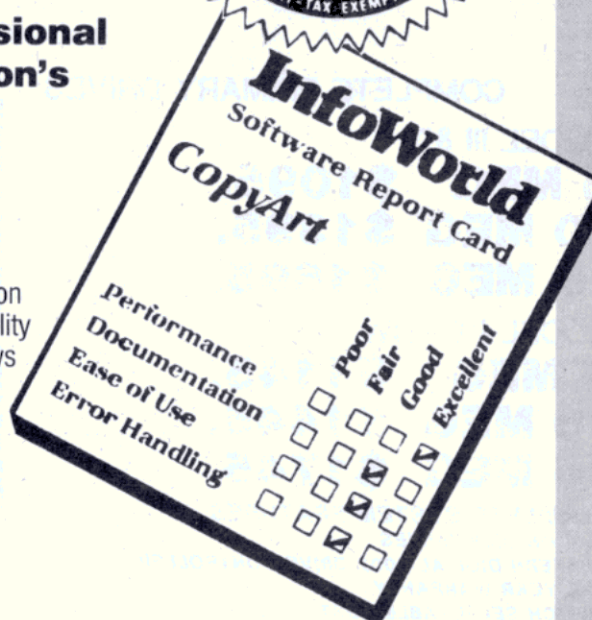
Epson MX-80, MX-80F/T, MX-100, FX-80 (all with or without Grafrax 80,
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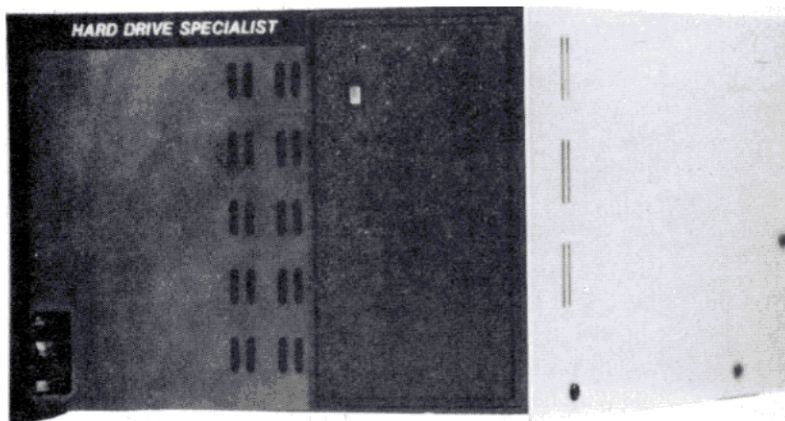
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NEW

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tion, contact Datafile Systems, 801 Welch Road, Suite 211, Palo Alto, CA 94304, 415-326-1447.

Reader Service ✓ 571

Pocket Program

Developer is a program for the Radio Shack PC-2 that rennumbers your Basic language programs, finds references to variables and line numbers within a Basic program, deletes blocks of lines, and doubles the reserve memory of the computer.

The renumbering function handles embedded line numbers, and avoids creating problems due to memory overflow. The cross reference function finds references to variables, arrays, commands, strings, statement numbers, and special characters. The reserve memory expander doubles the number of predefined function keys available during development.

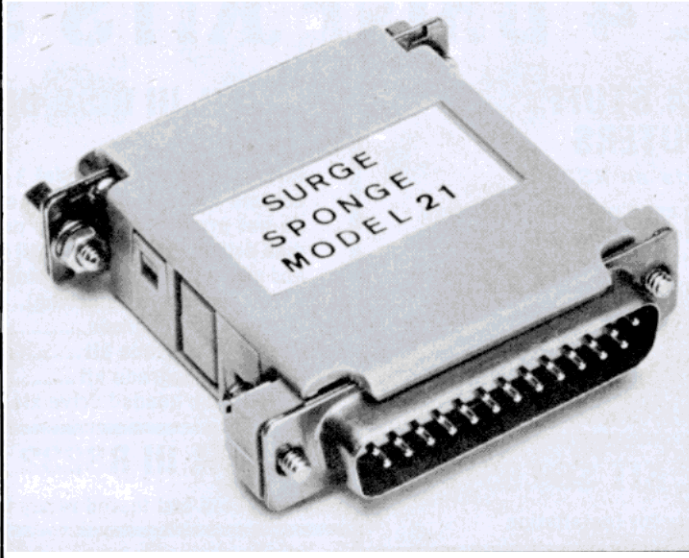
Sold on cassette for \$29.95, the Developer is available from PocketInfo Corp., P.O. Box 152, Beaverton, OR 97075, 503-649-8145.

Reader Service ✓ 562

Do Two Things at Once

DoubleTalk (DBLTalk) is a machine-language terminal program designed for use with CompuServe's electronic conference feature. It provides a split screen to take the headache out of on-line conferences. The top screen shows incoming messages, the bottom screen is for composing outgoing messages. This feature lets you send and receive messages at the same time. DBLTalk also provides a large capture buffer that you can print or retransmit.

DBLTalk sells for \$15, and is compatible with



The Surge Sponge offers your computer protection from power surges and lightning strikes.

Models I and III with at least 16K of memory. The program is available exclusively through Softex. CompuServe subscribers who want to purchase the program may visit Softex by entering the command GO PCS-40 at any prompt in the system. DBLTalk is listed under the Terminal Software option for Model I or III.

The system downloads DBLTalk to disk if you buy the program, but you must be using CompuServe's VIDTEX Executive program in order to do so. Complete documentation of DBLTalk is sent to you through the mail, but there is enough information available on-line to use DBLTalk right away.

For further information contact Saturday Software, P.O. Box 404, Catlettsburg, KY 41129, 606-739-6774.

Reader Service ✓ 557

Sponging It Clean

Protect your RS-232 interface from high voltage transients and lightning strikes with the Surge Sponge. It uses fast MOV devices to protect pins 2, 3,

4, 5, and 7 of the interface. Any voltage appearing on any of these pins that exceeds 27 volts is clamped to pin 1, Frame Ground. All pins of the RS-232 are wired through the Surge Sponge so that it appears transparent. It has no effect on standard RS-232 levels.

The Surge Sponge is packaged in a small plastic case measuring 2- by 2- by 1/2-inches with a male DB25 connector on one side and a female DB25 on the other. Both connectors are fitted with standard locking hardware to secure the Surge Sponge to your computer, printer, or cable. It incorporates PC board construction.

Priced at \$39.95 each, the Surge Sponge is available from Remark Datacom Inc., 4 Sycamore Drive, Woodbury, NY 11797, 516-367-3806.

Reader Service ✓ 572

Basic Converter

Now you can convert a compressed Basic program to an expanded format with the Basic Converter from LTCAP Inc. (102 Oak Bluff Drive, Palm Harbor, FL

33563, 813-937-8209). Besides compressing Basic programs, it also adds word-space delimiters around keywords, converts all PRINT@ values to the equivalent value and position of the 80-column by 24-line position, displays all data lines during conversion, and converts all token values to the Basic keyword.

The converted program uses a minimum amount of RAM and is compatible with Model II and 12 TRSDOS. If you have a Model 4, you can use the spool, MemDisk, sound, and filter features of TRSDOS 6.0 with this program.

Available on either TRSDOS 2.3 for the Model I, or TRSDOS 1.2 or 1.3 on the Model III, the Basic Converter costs \$29.95, on disk only.

Reader Service ✓ 576

Get Rid of Your Garbage

The Collector is an improved garbage collector for the Model I and III Disk Basic (garbage collection is the process of removing unused strings to make room for new ones). It replaces the ROM's garbage collection routine. It is this routine that sometimes causes your keyboard to lock up for seconds or minutes at a time. The Collector reduces these delays by 95 percent.

The program requires 500 bytes, plus 2 bytes for each active string. It works on both the Model I and III, and is supplied on a 35-track, single-density, Model I-formatted data disk. The Collector costs \$24.95 (\$26.45 in CA) plus \$2.50 shipping from Modular Software Associates (209 18th St., Huntington Beach, CA 92648, 714-960-6668).

Reader Service ✓ 580

Hard-Disk Drives

PH-Associates' product line now includes the DSS hard disk drive subsystems. This series features an 85-millisecond average access speed, 5¼-inch floppy physical size compatibility, heat dissipation less than 40 watts, and 5 megabit-per-second disk transfer rate. The drives use industry-standard Seagate ST-400 series compatible drives. The DSS series comes as a complete subsystem assembled in its own chassis.

This hard disk series is designed to provide economical disk storage for those of you who don't require high performance (capacity and speed). Formatted capacities of 5, 10, and 15 megabytes are available with list prices of \$1,995, \$2,295, and \$2,695 respectively. All versions interface with the Model II and any Z80 computer and come with a 90-day warranty.

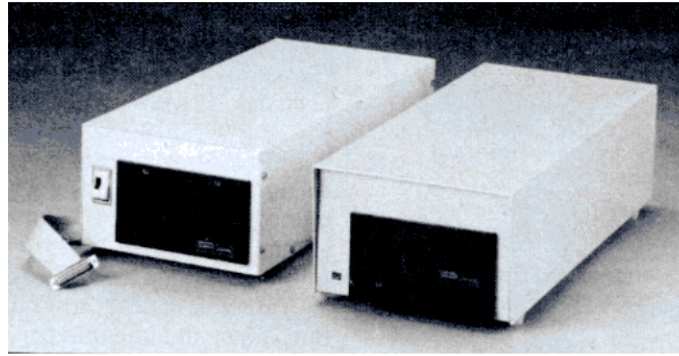
For further information on this series and their high performance Mark Series, contact PH-Associates Inc., 8720 Old Courthouse Road, Vienna, VA 22180, 703-281-5762.

Reader Service ✓ 575

Bind Your Data

If you're like most programmers, you're probably swamped in a sea of program listings. There's no need to drown in paper, however, with Inmac's Post Binders. Made of high-quality pressboard, the binders store both 12- by 8½-inch and 15- by 11-inch hard copies. Built-in suspension hooks let you store these binders in a vertical filing cabinet for easy filing and retrieval.

The Post Binders come in a variety of color schemes, including light blue, gray, dark blue, red, and green. Packed 10 to a box, they



The Mark (left) and DDS (right) Series of hard-disk drives from PH-Associates.

cost \$25.95 from Inmac, 2465 Augustine Drive, Santa Clara, CA 95051, 800-547-5444 (US), 800-547-5447 (CA).

Reader Service ✓ 569

Here Comes the Judge!

An inexpensive and compact ac line monitor, the Circuit Judge plugs into your 110-volt outlet and monitors your ac circuit for voltage surges. It detects surges of 300 volts or greater, high voltage in excess of 125 volts, low voltage of 100 volts or less, and power loss.

When any of these disturbances occur, the Judge triggers an LED display and stops its digital clock at the time and date of the anomaly. This lets you investigate recurring blackouts, surges, or low-voltages from different sources, like circulator pumps and circuit breakers. The Circuit Judge maintains its warning until you reset it.

Available from Digitronics (Comtec Information Systems Inc., 53 John St., Cumberland, RI 02864), the Circuit Judge costs \$129.95.

Reader Service ✓ 583

Mail Call!

PowerMail Plus is a mass mailing system written entirely in machine language for maximum operating speed. Since you can span

disks, there is no limit on the number of names you can store. You can define up to 24 flags to incorporate into the program so that when you enter a name it is cataloged in any manner you define.

The program does not pre-allocate the entire drive, but lets you define the size of your file during initialization. The program also sorts on any 10 levels, if you so desire. It separates your flags and puts them into another file, merges files together and then separates the data you want, and performs key searches. It has improved field lengths, disk I/O, and print routines.

PowerMail has nine print

options, including printing labels or listings. You can control the print system from flag settings, letting you print file subsets. You can also reset the flags after printing in order to keep track of who has been sent a particular mailing.

The program runs in as little as a 32K one-drive environment, but 48K with dual drives is recommended. It also works on hard disk drives under LDOS, DOS-PLUS, or TRSDOS 6.0. Since it doesn't require separate versions for floppy or rigid disks, you can upgrade your system at any time without affecting your data.

Versions of PowerMail are available for the Models I/III/Max-80, Model 4, and Models II/12/16 (Z80). They retail for \$150 each, and come with complete documentation. For further information, contact PowerSoft Products, 11500 Stemmons Fwy., Suite 125, Dallas, TX 75229, 214-484-2976.

Reader Service ✓ 565

Win the Super Bowl!

All you football fans out there can hedge your bets with the new data-base and



Know the time and date of a power failure with the Circuit Judge.

SUPER FAST!

Z80

DISASSEMBLER

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- Two pass operation - generates labels at referenced locations
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- Allows user defined labels
- Allows define byte, define word and define space directives
- COMPLETE cross-reference
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- Generates mnemonics for CP/M system calls
- Illegal instructions generate define byte sequence
- Start and stop at any location in file
- Source or complete listing type output

SPEED - disassembles a typical 17K .COM file, generating a 110K .Z80 file (over 10,000 lines of source) and a 52K .XRF file in less than 1 minute 45 seconds using standard bios and 8" SS/SD!

Available for Z80 CP/M and TRS-80 III

SLR Systems

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Terms: add \$2 shipping US, others \$5. PA add 6% sales tax.
Specify format required. Check, MO, Visa, M/C, COD accepted
Z80, CP/M, TRS-80 TM's of Zilog, Digital Research, Tandy Corp resp

NEW PRODUCTS

operating program developed by Eastern Computer Consulting Associates Inc. (11 Dick Drive, Worcester, MA 01609, 617-757-3131). The Pro Sports Stats program doesn't attempt to pick the winner of any game; instead, it lets you probe more than a decade of information in order to find out how any team performed against a spread under whatever criteria you choose.

Typical questions it can answer include: What is Miami's record against the spread in every game against Buffalo since 1978? What is a particular team's chance of beating the spread when playing at home after three consecutive wins against the spread?

The operating program and data base are priced at \$495. With the proper equipment, you can get weekly updates of all current data (scores, coaches, spreads, and surfaces) added to your database. The program works on any Model I, II, III, 4, 12, or 16 running on TRSDOS.

As an additional teaser, Pro Sports Stats has demonstrated an 80-90 percent accuracy rate in determining a team to beat the spread. Rah, rah!!

Reader Service ✓ 577

Just What the Doctor Ordered

The RS-232 Analyzer lets you diagnose, monitor, and connect any device or computer that uses the RS-232 interface. The Analyzer monitors nine RS-232 signals and displays their status using bicolor LEDs. With it, you can detect and monitor inactive, high, low, and fluctuating signals.

The Analyzer has internal switches so you can easily interconnect your computer with the most common computer interfaces. It also lets you cross-wire any connection in order to connect other devices to your computer. Since the Analyzer is a plug-in adapter, you can leave it permanently wired in any circuit.

It sells for \$149.95, and comes complete with a manual containing detailed examples of how to hook up the RS-232 Analyzer with computer peripherals. For further information, contact Personal Computer Products at 1400 Coleman Ave., Suite C-18, Santa Clara, CA 95050, 408-988-0164.

Reader Service ✓ 579

To Buy or Not To Buy

The Real Estate Activities Program (REAP) is de-

MODEL 4 OWNERS

CONVERT your MODEL I/III PROGRAMS TO RUN ON MODEL 4

Do you have a lot of time and money invested in Model I/III software, well now you can convert Model I/III BASIC programs to Model 4 with CONVERTR.

CONVERTR will eliminate unnecessary spaces and insert all required spaces in your BASIC programs. CONVERTR will identify lines which contain keywords not supported by Model 4. CONVERTR will identify lines and keywords which the Model 4 handles differently. CONVERTR is menu driven and includes an option to list your program and error table on your printer.

CONVERTR comes on a disk and includes an instruction booklet on How to Convert your BASIC programs.

CHECK - MONEY ORDER

COD -  - 

CONVERTR

1 DRIVE SYSTEM - 89.00

2 DRIVE SYSTEM - 79.00

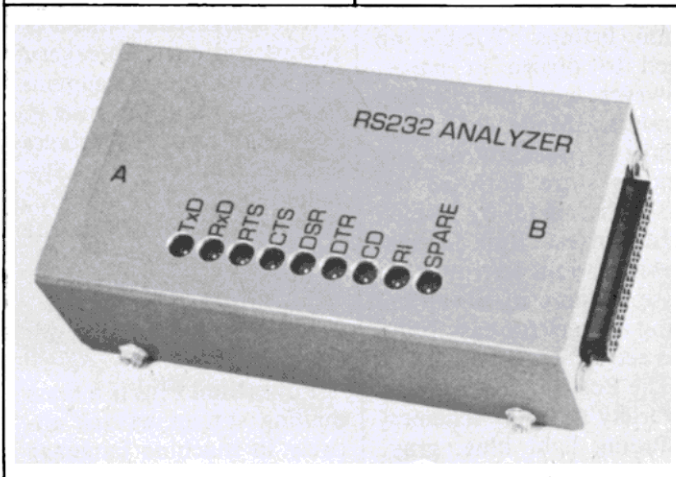
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DEPT 10 BOX 195 ✓356

HARTLY, DE 19953

PHONE 5 pm-9 pm M-F

9-5 Sat (302) 492-8463



The RS-232 Analyzer: It monitors your RS-232 interface signals.

NEW PRODUCTS

signed to provide you, the owner or potential owner of income property, a method of investigating the effects of various actions on the property. It allows easy comparisons of the key factors influencing your decision to buy or sell, methods of financing, and methods of sale while taking into account various tax considerations.

REAP calculates the return on equity, effects of equity build-up on mortgage principle, and depreciation of real property. You can estimate the effects of financial decisions on federal income tax on ordinary income, capital gains income, and real estate income. You can also determine the effects of different disbursement methods of your property, find the amount of income tax to be reported in the year of sale, and perform tax-deferred exchange analysis.

The 35-page manual includes forms and examples of how you can use REAP for individual tax analysis, comparative investment analysis, property analysis, exchange basis analysis, and installment sale analysis. REAP costs \$39.95 and runs on both the Model I

and III. Contact BV Engineering, P.O. Box 3351, Riverside, CA 92519, 714-781-0252.

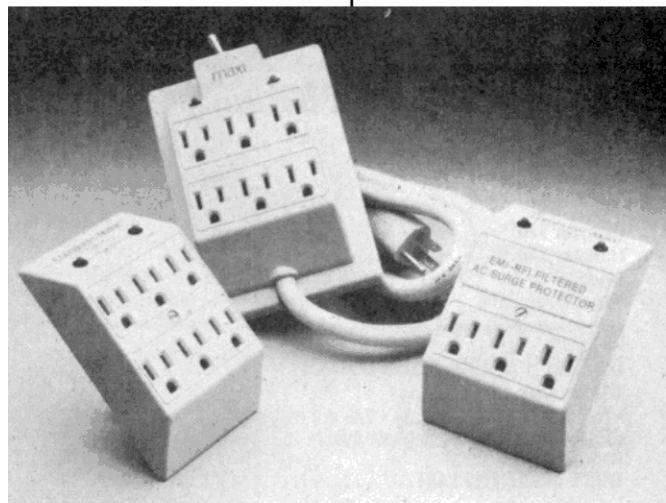
Reader Service ✓ 568

Avoid the Surge

Your computer components can be safe from power surges and over-voltage transients with the Surge Suppressor from Computer-Mate. There are three models to choose from: Micro, Maxi, and Mini. All three solid state voltage-clamping devices you can easily implant into any three-wire duplex outlet.

The Micro Surge Suppressor has six outlets and a steady state heat dissipation at 25 C-40W. It sells for \$59.95. The Maxi model also has a steady state heat dissipation at 25 C-40W and six outlets, plus a 4½-foot power cord. It sells for \$89.50. The Mini Surge Suppressor is listed at \$97.50 and has EMI-RFI filtering to eliminate electric fuzz and noise. All three suppressors clamp normal mode voltage (line to line) and ground voltage.

You can buy the Surge Suppressors from participating dealers or directly from



Three models of ac surge suppressors from Computer-Mate.

MODEL 4 OWNERS

PEACHPAK 4 ACCOUNTING FOR YOUR MODEL 4

Now, for the first time, TRS-80 Model 4 owners can buy professional accounting software to run under TRSDOS 6.0. This is the Peachtree Series 4 accounting package which has been one of the most popular CP/M based accounting packages for several years. The package includes:

- * General Ledger
 - Up to 800 accounts
 - 1000 transactions per period
 - 99 departments / optional departmental income statements
 - User defined financial statements
- * Accounts Receivable
 - 500 Accounts
 - 700 transactions per period
 - Posts transactions to GL
 - Mixed open-item and balance-forward accounts
- * Accounts Payable
 - 500 Vendors
 - 500 transactions per period
 - Auto or manual select of invoices to pay
 - Prints checks and detailed stubs

All three packages for just \$495.00

These packages have been adapted to TRSDOS 6.0 by Compu-Systems Software and include the standard CP/M packages with the TRSDOS 6.0 diskettes and complete documentation.

COMPU-SYSTEMS SOFTWARE
212 Skylark Ct.
Norman, OK 73069
(405) - 377-8570

Call or write for brochures on these and other Compu-Systems Software products.

✓447

FREE business software directory

- Radio Shack's Model 1, 2, 3 & 16
- CPM: Xerox, Alto...
- IBM Personal Computer & compatibles

"(DBMS) is GREAT!"

-publisher of 80-US

"(GL) superior to either the Osborne (SBSG & Taranto) or Radio Shack...MAIL-X has a greater capacity...more flexible than (R.S.)"

-columnist of 80-microcomputing

"imperceptively fast...(DBMS) is a good and reliable workhorse"

-publisher of Interface Age

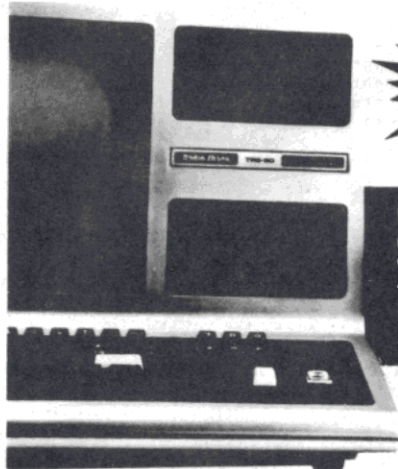
Data base manager, integrated accounting package (AR, AP, GL & Payroll), inventory, word processing, and mailing list. Compare and be selective! Top-quality software at mass-production prices!



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✓149

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FREE! DOSPLUS 3.4**
disk operating system
with any Percom or
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for the Model III*

PERCOM™ QUALITY FOR YOUR MODEL III™

Nothing but the best for your "Model III". Percom internally mounted drive systems: including 4 drive controller with gold edge connectors, double density disk drive or drives, all hardware and cabling. A free copy of DOS Plus 3.4 is also included with every first drive purchase.

TFD 340N1 one drive single sided double-density **\$449.00**
TFD 340N2 two drive single sided double-density **\$699.00**

Brand Spankin' New! SALE Dual Headed Drives for the Price of Flippies!

Now you can have a "dual headed" PERCOM™ Drive System for your "Model III"!!

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TFD344N2 Two disk dual headed double-density **\$860.00**

*completely compatible with programs existing on single sided or double sided diskettes.

WE HAVEN'T FORGOTTEN THE MODEL I™!!

Upgrade your Model I™ to Double Density All for **\$129.95!!**

You have a good system and you just don't want to sell out to a Model III - Upgrade with the Percom Doubler II, the overwhelming favorite double density adapter for over 2 years! Simply plug the adaptor into your expansion interface and run either single or double-density programs. Comes complete with FREE DOS Plus 3.4 but will also run with LDOS NEW DOS 80 and TRS DOS.

PERCOM™ QUALITY FOR YOUR MODEL I™

TFD40-1 40 track single sided drive **\$275.00**
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Percom™ Hard Disk — Quality for your System

- works with existing floppy drives Reg. from \$2495
- can be daisy-chained up to four hard disks
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- Now available for immediate delivery in 5 & 10 megabyte configuration
- Can be used for Model I*, II*, III*, "Apple II" or "IBM PC" computers.

DOS + 3.4 Reg. \$159.00. Sale **\$99.95**

CLOSEOUT!!!!!!

Flippy And 80 Track Drives Reduced!!!!!!
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TRS-80™ MODEL 100 PORTABLE COMPUTER

"The Executive Micro Workstation"

• Powerful Built-in Software:

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- Terminal Communications
- Telephone Dialer
- Applications Software
- Extended Basic
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• Retains Memory Data When "off"

• Self-contained Telephone Modem

With 8K ONLY **\$799.00**
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PowerSOFT Software from Breeze/QSD Inc.™

One disk "BOOTS" up on either machine. At PowerSOFT, we don't believe in making a customer buy a separate version for Mod I or III. We ALWAYS include BOTH versions on the SAME disk for your maximum convenience. 80 Track versions are available on request. All titles are for Mod I or III unless specified.

PowerSOFT Product Title	Retail Price
SUPER UTILITY PLUS/3.0	\$ 79.95
SUPER UTILITY PLUS/3.0 for MAX80	\$ 99.95
INSIDE SU + /3.0 MANUAL	\$ 19.95
SU + /3.0 TECH MANUAL	\$ 14.95
INSIDE SU + /2.2z MANUAL	\$ 19.95
SU + /2.2z TECH MANUAL	\$ 14.95
"THE TOOLBOX" for LDOS	\$ 69.95
"MASTER MECHANIC SET" for LDOS	\$ 39.95
POWERDRIVERS for SuperScript™ (printer drivers):	
POWERDRIVER/E (EPSON MX-80/100)	\$ 29.95
POWERDRIVER/P (PROWRITER)	\$ 29.95
POWERDRIVER/F (F-10 STARWRITER)	\$ 29.95
POWERMAIL	\$ 99.95
POWERMAIL PLUS* — Mod I, III, MAX80	\$150.00
POWERMAIL PLUS* — Mod II/12/16	\$150.00
POWERDRAW	\$ 39.95
POWERDOT (EPSON or PROWRITER Only)	\$ 49.95
POWERTERM Smart Terminal Pkge	\$ 29.95
DOSPLUS II Operating System	\$249.95
For Model II, 12, and 16/280	
SCRIPUS 3.0	\$ 39.95
THE BASIC/S COMPILER SYSTEM	\$ 49.95
MAKE/80 (Mod I or III)	\$ 19.95
SUPER UTILITY (Mod I ONLY!)	\$ 29.95
QUICK-FIX (Mod I ONLY!)	\$ 19.95

*Coming out very soon. Please inquire for shipping date.

BIG DISCOUNTS ON PRINTERS

NEW! Brother DX15™	Only \$ 559.00
New! Brother NR1A™	Only \$ 899.00
Microprism™	Only \$ 699.00
C. Itoh F10™	Only \$1495.00
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All Models Call for our superlow prices!	
All Models Call for our superlow prices!	

DIABLO™ MODEL 2300 MATRIX PRINTER

Close Out Special —

• Rugged, commercial duty • 7x9 dot matrix • High Speed! 200 CPS! • Top of the line, highest quality
Reg. Retail \$2495.00

FOR LIMITED TIME ONLY!
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Computer-Mate Inc. at 1006 Hampshire Lane, Richardson, TX 75080, 800-527-3643 (US), 800-442-4006 (TX).

Reader Service ✓ 573

In-Memory File Manager

RAMFILE is an in-memory file management system that you call from Basic programs. It lets you manipulate information using the RAM memory of the Model I or III to efficiently store, retrieve, select, and sort data files. This frees you from developing complex string and numeric arrays, sorts, and search routines. Data can be saved to tape or disk for future use.

The cassette version sells for \$49.95; the disk version is \$59.95. RAMFILE is sold by Individual Systems Inc., P.O. Box 343, Downers Grove, IL 60515, 312-968-2337.

Reader Service ✓ 564

Software Reference Guide

Are you looking for software, but don't know what's available? Then take a look at *Microcomputer Programs in Print*. It's a comprehensive reference guide to personal computer software that covers 2,700 programs for over 150 microcomputers.

It is completely indexed with 280 software categories for business, educational, personal, games, and systems software. A sampling of the programs include speech synthesizers, database managers, operating systems, programming aids, electronic mail, accounting, engineering, word processing, space games, and much more.

With *Programs in Print* you can compare and con-

trast programs, find out how to get software at a discount by mail-order, and who to call at more than 370 software companies for technical advice. A key allows fast searches for individual systems.

Microcomputer Programs in Print, a 208-page softbound book, costs \$19.95 plus \$1.50 shipping and \$.80 state tax (a total of \$22.25) from Postroad Press Inc. (P.O. Box 1212, Roanoke, VA 24006, 703-342-9797).

Reader Service ✓ 570

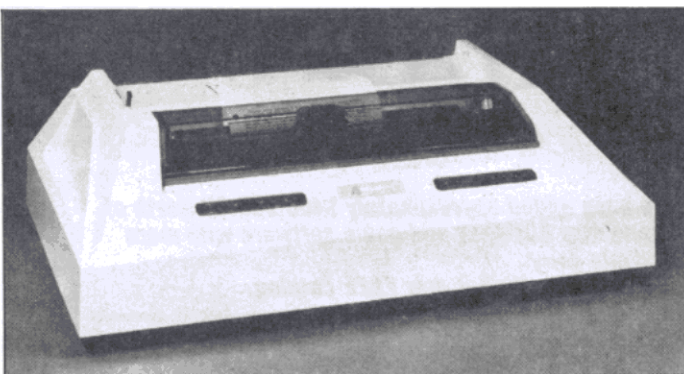
Get It Done Fast

If you're in a rush, print your report or program on the DP-6500 Rapid Scribe dot-matrix printer. It prints 500 characters per second (cps) at 10 characters per inch (cpi) and 540 cps at 12 cpi. In the 80-column print mode, the Rapid Scribe prints 275 lines per minute.

Key to the high printing speeds is an 18-pin print head consisting of two vertical columns of nine print pins each. Since the two columns of print pins are adjacent to each other, you can print two identical columns of dots at one time, doubling the printing speed.

Features of the Rapid Scribe include an enhanced mode with proportional spacing or at 10, 12, 15, and 16.4 cpi at speeds up to 410 cps. The high-resolution graphics mode provides a dot resolution of either 72 or 144 dots per inch. Character sets include Swedish, Danish, German, French, Spanish, Italian, and standard U.S. ASCII.

Options include character font downloading from the host computer, alternate character fonts in PROM, and UPC and Code 39 bar codes. Rapid Scribe provides buffer storage of 4.5K bytes with an additional



The Rapid Scribe Printer: an appropriate name for Anadex's 500 cps printer.

16K bytes optional. It has both Centronics parallel and RS-232 ports for your computer system.

Available from Anadex Inc. (9825 De Soto Ave., Chatsworth, CA 91311, 213-998-8010), its suggested list price is \$2,995.

Reader Service ✓ 554

Photograph Your Screen

Verify your game scores for the Gamer's Cafe scoreboard with Kodak's Instagraphic CRT Imaging Outfit, a quick and inexpensive way to make instant color prints of your computer screen's display. Designed with the photography neophyte in mind, the

Imaging Outfit comes complete with an Instagraphic camera with close-up lens, two packages of Instagraphic color print film, filter, Instagraphic CRT cone, an instruction manual, and brackets for adapting a 35mm single-lens reflex camera to the cone.

To take a picture, the cone, with camera attached, is placed over the screen. This eliminates any problems with ambient light and parallax, while holding the lens at the correct distance from the screen. The Kodak Wratten filter can be used to balance color for the phosphor in your video display.

When everything is ready, simply press the exposure button for a few seconds.



Kodak's inexpensive Instagraphic CRT Imaging Outfit lets you photograph images on your screen.

There's no need to set the focus or worry about the proper exposure; the Instagraphic camera does it automatically for you. You can leave the color prints on the backing, or remove them after one hour. Without the backing, the print is as thick as a conventional print and measures 3½ by 4 inches.

The Instagraphic outfit costs \$195 and is available either from Kodak dealers or directly from Kodak (343 State St., Rochester, NY 14650, 716-724-3169). Instagraphic color print film is sold in 50-exposure, five-carton packages at approximately \$55 per five-pack.

Reader Service ✓ 578

New Tandy Printer

The Radio Shack DMP-120 is an impact dot-matrix printer capable of printing monospaced and graphics characters. It features bidirectional minimum-distance access carriage motion and software-controlled full, half, and three-quarters forward line feed. A variety of pitches are software or switch selectable, including 10, 12, and 16.7 characters per inch. Underline and elongation modes are also available.

Ideally suited to data pro-

cessing, it prints 120 characters per second and is code compatible with all other Radio Shack printers. You can use the DMP-120 with standard typewriter paper, 8½-inch roll paper, or computer fanfold forms. It prints one original and up to two carbon copies simultaneously.

Priced at \$499.95, the DMP-120 printer is available from your local Radio Shack Computer Center and participating Radio Shack stores and dealers. For further information contact Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102, 817-390-3300.

Reader Service ✓ 552

Stack 'em Away!

Store your floppy disks neatly and safely in StorWare file/storage boxes. They are stackable, fit easily on your disk drive, and come in walnut woodgrain or black leatherette finish. Both the lid and box are double construction, joined with a double-reinforced vinyl hinge. StorWares are shipped fully assembled and include a three-position adjustable divider inside.

Available in two sizes,



StorWare's classy disk files: They give you accessibility while protecting your disks.

one capable of storing 75 disks and the other 150 disks. StorWare boxes cost \$9.95 and \$14.95 respectively. In addition, you can purchase an optional universal index label kit for \$2.95. It contains 56 pressure-sensitive labels and five styrene dividers. Widely used title names are preprinted on 34 of the labels, the other 22 left blank for your title choices.

Both products are sold by StorWares Inc., 1849 East 65th St., Dept. S, Cleveland, OH 44103, 800-421-4637.

Reader Service ✓ 556

A Star is Born

WordStar, a widely used word processing program from MicroPro, now runs on LDOS for Model I and III owners. One of the first word processors, it features horizontal scrolling, columnar data insertion, automatic file backup when opening a document, and the ability to save a block of text to a file of your choice. The screen displays page number, line number, and column position plus ad-

justable levels of online help.

When printing, you can define print codes, redefine heads and footers as necessary, and set conditional page breaks (i.e., if there are fewer than so many lines on the page, start a new page).

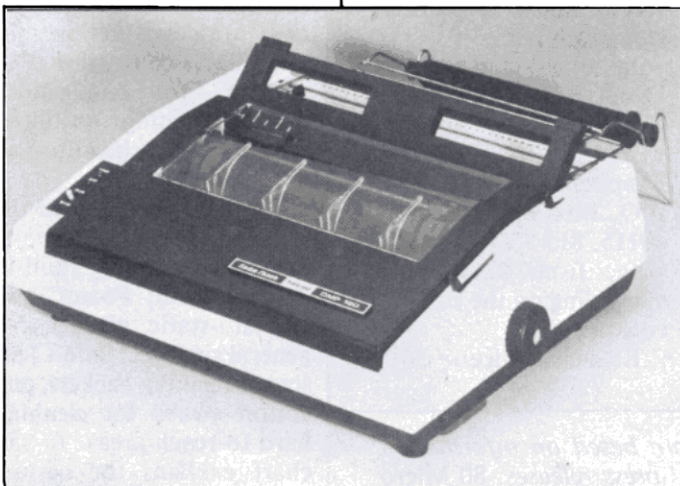
WordStar is provided on Logical Systems' small-DOS operating system and runs on all LDOS 5.1.3 implementations, hard disk, or floppy. In addition, WordStar lets you use the LDOS K1/DVR and keyboard filters, as well as the standard printer driver and any filters.

Priced at \$395, WordStar is available from MicroPro International Corp., 33 San Pablo Ave., San Rafael, CA 94903, 415-499-1200.

Reader Service ✓ 563

Show the World

Let everyone know how you feel about computers by wearing computer jewelry from Simplified Computer Systems Inc. (P.O. Box 3603, Nashua, NH 03061, 603-889-4068). Made from



The DMP-120 is a fast, general-purpose, dot-matrix printer from Radio Shack.



The perfect Christmas gift: pewter jewelry from Simplified Computer Systems.

solid pewter, SCS Computer Jewelry features the three most familiar computer components: The video display terminal, printer, and floppy disk.

Each is crafted in fine detail. The 1/2-by 7/8-inch video display piece clearly shows the two disk drives, a screen, a row of function keys, and standard and alphanumeric keyboards.

Charms cost \$6 each; tie tacks or lapel pins \$7; pendants \$8.

Reader Service ✓ 550

Let It Hang Around with You

Tired of carrying your Model 100 under your arm? If so, then perhaps you need the Stephens MStrap. With this convenient nylon carrying handle you can hand- or shoulder-carry your Model 100 almost anywhere.

The MStrap is available in black to match the Model 100's color scheme, and its installation, which takes under five minutes, doesn't void any of Tandy's warranties.

Priced at \$12, including a lifetime guarantee, the MStrap is sold by The Donald Stephens Company, 1962 Pommel Ave., Las Vegas, NV 89119, 702-739-6113.

Reader Service ✓ 551

Filtered Outlet

Feed your computer equipment clean and stable power with a little help from the Wire Tree, a voltage surge and noise protection device. It mounts conveniently underneath your desk or table and has four plug-in outlets. This helps you control and organize your workstation's tangle

of power cords. The Wire Tree also gives you control over the total system power with a single illuminated on/off switch.

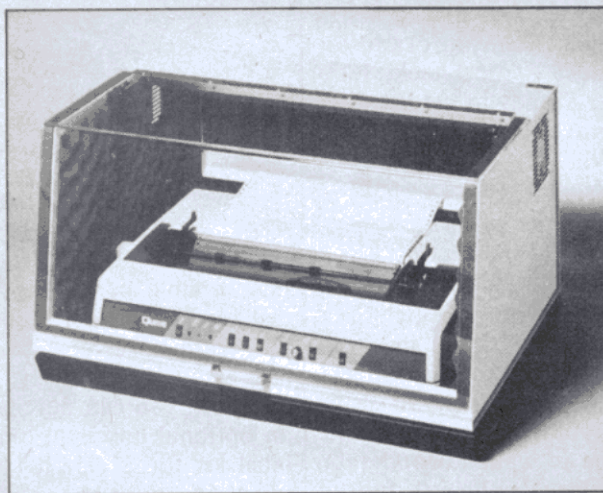
The first of the Networx line, the Wire Tree costs \$69.95 and is sold by Networx, 203 Harrison Place, Brooklyn, NY 11237, 212-821-7555.

Reader Service ✓ 574



The Wire Tree provides your computer with clean power.

DIFFERENT TRACK



Through the looking glass: UARCO's Acoustical Printer Enclosure silences your printer to a whisper.

Peace and Quiet

No, it's not a microwave oven that fries your printer when you get mad. It's an acoustical printer enclosure from UARCO Computer Supplies that silences your printer's noise. The custom-fitted units are made of rugged yet lightweight metal, and are lined with sound-absorbing material. The plexiglass cover design allows normal access and operation.

You can install the enclosures in seconds without

printer modifications. Over 250 models are available to fit the major printers, including Diablo, NEC, Qume, DEC, Centronics, Radio Shack, Okidata, Epson, Tally, Ricoh printers, and more. The Acoustical Printer Enclosures are shipped fully assembled from UARCO Computer Supplies, 121 North 9th St., P.O. Box 948, DeKalb, IL 60115, 815-756-9581. Prices range from \$214 to \$520 depending on the size of the enclosure.

Reader Service ✓ 561

New Products listings are based on information supplied in manufacturers' press releases. 80 Micro has not tested or reviewed these products and cannot guarantee any claims.

Computer Disk Wash

Give your computer a complete clean-up with Safe-Kit from Automation Facilities Corp. (Financial Plaza, 1st Floor, 3916 State St., Santa Barbara, CA 93105, 805-687-7040, \$68.95). Produced in a compact, refillable book format, the kit contains products to clean your computer's disk drives, screen, keyboards, and consoles.

The disk head cleaners come in 8- and 5 1/4-inch drive sizes that prevent contamination by using a disposable wet/dry action—you use a fresh disk for every cleaning operation. The system includes a Freon solvent and doesn't rely on dry abrasive action for cleaning. A conversion label is used for single-sided drives, creating no interference with head-to-pad pressure.

Products included in the kit include SafeClene, a tape-drive cleaning fluid in aerosol form; FoamClene, an anti-static cleaner for general surfaces; Safe-Clens screen cleaning packets; and cotton swabs for cleaning hard-to-reach areas. A wall chart explains the correct cleaning procedure for different computer systems.

Reader Service ✓ 582

If you guessed that a Practical Peripherals Microbuffer™ printer buffer saves time, you're right. For the way it works, this inexpensive product is the most practical addition to your microcomputer system ever.

With Microbuffer, you don't have to wait for your printer to finish before you resume using your computer. Data is received and stored at fast speeds, then released from Microbuffer's memory to your printer. This is called buffering. The more you print, the more productive it makes your workflow.

Depending on the version of Microbuffer, these buffering capacities range from a useful 8K of random access memory — big enough for 8,000 characters of storage — up to a very large 256K — enough for 256,000 characters of storage.

Practical Peripherals makes stand-alone Microbuffers for any computer and printer combi-

nation, including add-on units especially for Apple II computer and/or Epson printers. Each has different features like graphics dumps and text formatting besides its buffering capabilities. You can choose one that's just right for your system.

Best of all, they're built to last and work exactly like they're supposed to.

If you're still guessing whether you can afford to have one, talk with any computer dealer. That's the best way to find out how practical a Practical Peripherals Microbuffer is.

**PRACTICAL
PERIPHERALS**

31245 La Baya Drive
Westlake Village, CA 91362
(213) 991-8200

GUESS WHO HAS MICROBUFFER.™



That's what you get with the LNW80 Model 2—undoubtedly the most versatile, powerful and fully equipped microcomputer in its class today. A machine so superior in concept and design, that it will define the standards of microcomputer performance for years to come.

VERSATILITY

The LNW80 2 performs wonders with the most complete library of software available to any microcomputer on the market today. Every LNW80 2 comes complete with this outstanding library of Business Software. **LNW SMALL BUSINESS AND PROFESSIONAL ACCOUNTING SERIES™**

General Ledger, Accounts Receivable, Accounts Payable, Payroll; **ELECTRIC SPREADSHEET™**; **ELECTRIC PENCIL™** **WORDPROCESSOR**; **MICROTERM™** **MODEM PROGRAM**; **CHART EX™** **HIGH RESOLUTION BUSINESS GRAPHICS CHARTING PROGRAM**; **CP/M 2.2™**; **DOSPLUS™**; **LNW-BASIC™**; **MICROSOFT BASIC™**. In addition to a comprehensive line of LNW80 2 Software, it is also fully compatible with software from TRS80® (Models 1, 3, 4), CP/M® and Cromemco® worlds—a capability which gives you access to the most extensive and mature libraries of business, scientific, engineering and entertainment software applications. So no matter how far you expand into user applications, the LNW80 2 will expand right along with you.

POWER

The LNW80 2 performs miracles with the computing power of 96K RAM (standard) of user memory matched with a mass storage capability which handles 5¼" floppy disks and 5¼" hard disk drives. And while the unit comes with built-in

controllers for 5¼" and 8" floppy disks (single/double sided, single/double density, up to 4.5 Megabytes capacity), the LNW80 2 also gives you the unique ability to read and write diskettes from a greater variety of other popular computers than does any other microcomputer. So regardless of how big you grow, you will never end up with thumb-twiddling down time while you expand to a more powerful system. The LNW80 2 will always have enough muscle to handle your biggest and toughest jobs.

FULLY EQUIPPED

The LNW80 2 was developed to anticipate the needs of both expansion and compatibility. So the computer was designed with enough built-in features to keep you from having to spend a small fortune as you move down the road to higher levels of user sophistication. Standard features include high and low resolution graphics in both color and black-and-white, an asynchronous serial communication channel, and a wide variety of tape, printer, monitor and hardware expansion ports. In addition, the LNW80 2 contains an array of quality construction features that fully justify its remarkable one-year limited warranty.

So if you're looking for a microcomputer that will satisfy your performance needs as you grow and develop, take a long, hard look at the LNW80 2. It's the one microcomputer built to meet the challenges of tomorrow—for a long time to come.

For more information and the name of the dealer nearest you, write or telephone:

LNW Computers ✓31
2620 Walnut, Tustin, California 92680
Telephone: 714/544-5744



STATE-OF-THE-ART ENGINEERING
STATE OF TOMORROW PERFORMANCE.

LNW COMPUTERS